THE

PURSUIT OF KNOWLEDGE

UNDER DIFFICULTIES.

BY

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A NEW EDITION, REVISED AND ENLARGED.

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THE

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CHAPTER I.

GIFFORD; HOLCROFT.

AMONG narratives which illustrate the power of the Love of Knowledge in overcoming the opposition of circumstances, there are few more interesting than that which has been given us of his early life by the late WILLIAM GIFFORD. Mr. Gifford was born in 1755 at Ashburton, in Devonshire. His father, although the descendant of a respectable and even wealthy family, had early ruined himself by his wildness and prodigality; and even after he was married had run off to sea, where he remained serving on board a man-of-war for eight or nine years. On his return home, with about a hundred pounds of prize-money, he attempted to obtain a living as a glazier, having before apprenticed himself to that business; but in a few years he died of a broken-down constitution before he was forty, leaving his wife with two children, the youngest only about eight months old, and with no means of support except what she might make by continuing the business, of which she was quite ignorant. In about a twelvemonth she followed her husband to the grave. "I was not quite thirteen," says

her son, "when this happened; my little brother was hardly two; and we had not a relation nor a friend in the world."

His brother was now sent to the workhouse, and he was himself taken home to the house of a person named Carlile, who was his godfather, and had seized upon whatever his mother had left, under pretence of repaying himself for money which he had advanced to her. By this person, William, who had before learned reading, writing, and a little arithmetic, was sent again to school, and was beginning to make considerable progress in the last branch of study; but in about three months his patron grew tired of the expense, and took him home, with the view of employing him as a ploughboy. An injury, however, which he had received some years before, on his breast, was found to unfit him for this species of labour; and it was next resolved that he should be sent out to Newfoundland to assist in a storehouse. But, upon being presented to the person who had agreed to fit him out, he was declared to be "too small"—and this scheme also had to be abandoned. "My godfather," says he, "had now humbler views for me, and I had little heart to resist anything. He proposed to send me on board one of the Torbay fishing-boats: I ventured, however, to remonstrate against this, and the matter was compromised by my consenting to go on board a coaster. A coaster was speedily found for me at Brixham, and thither I went when little more than thirteen."

In this vessel he remained for nearly a twelvemonth. "It will be easily conceived," he remarks, "that my life was a life of hardship. I was not only 'a ship-boy on the high and giddy mast,' but also in the cabin, where every menial office fell to my lot; yet, if I was restless and discontented, I can safely say it was not so much on account of this, as of my being precluded from all possibility of reading; as my master did not possess, nor do I

recollect seeing during the whole time of my abode with him, a single book of any description except the 'Coasting Pilot.'"

While in this humble situation, however, and seeming to himself almost an outcast from the world, he was not altogether forgotten. He had broken off all connexion with Ashburton, where his godfather lived; but "the women of Brixham," he says, "who travelled to Ashburton twice a-week with fish, and who had known my parents, did not see me without kind concern running about the beach in a ragged jacket and trousers." They often mentioned him to their acquaintances at Ashburton; and the tale excited so much commiseration in the place, that his godfather at last found himself obliged to send for him home. At this time he wanted some months of fourteen. He proceeds with his own story as follows:—

"After the holidays I returned to my darling pursuit—arithmetic: my progress was now so rapid that in a few months I was at the head of the school, and qualified to assist my master (Mr. E. Furlong) on any extraordinary emergency. As he usually gave me a trifle on those occasions, it raised a thought in me that, by engaging with him as a regular assistant, and undertaking the instruction of a few evening scholars, I might, with a little additional aid, be enabled to support myself. God knows, my ideas of support at this time were of no very extravagant nature. I had, besides, another object in view. Mr. Hugh Smerdon (my first master) was now grown old and infirm: it seemed unlikely that he should hold out above three or four years; and I fondly flattered myself that, notwithstanding my youth, I might possibly be appointed to succeed him. I was in my fifteenth year when I built these castles; a storm, however, was collecting, which unexpectedly burst upon me, and swept them all away.

"On mentioning my little plan to Carlile, he treated

it with the utmost contempt; and told me, in his turn, that, as I had learned enough, and more than enough, at school, he must be considered as having fairly discharged his duty (so, indeed, he had); he added, that he had been negotiating with his cousin, a shoemaker of some respectability, who had liberally agreed to take me without a fee as an apprentice. I was so shocked at this intelligence that I did not remonstrate; but went in sullenness and silence to my new master, to whom I was soon after bound,* till I should attain the age of twenty-one."

Up to this period his reading had been very limited, the only books he had perused, beside the Bible, with which he was well acquainted, having been a black-letter romance, called Parismus and Parismenes, a few old magazines, and the Imitation of Thomas à Kempis. "As I hated my new profession," he continues, "with a perfect hatred, I made no progress in it; and was consequently little regarded in the family, of which I sank by degrees into the common drudge: this did not much disquiet me, for my spirits were now humbled. I did not, however, quite resign my hope of one day succeeding to Mr. Hugh Smerdon, and therefore secretly prosecuted my favourite study at every interval of leisure. These intervals were not very frequent; and, when the use I made of them was found out, they were rendered still less so. I could not guess the motives for this at first; but at length I discovered that my master destined his youngest son for the situation to which I aspired.

"I possessed at this time but one book in the world: it was a treatise on algebra, given to me by a young woman, who had found it in a lodging-house. I considered it as a treasure; but it was a treasure locked up; for it supposed the reader to be well acquainted with simple equations, and I knew nothing of the

* "My indenture, which now lies before me, is dated the 1st of January, 1772."

matter. My master's son had purchased 'Fenning's Introduction:' this was precisely what I wanted—but he carefully concealed it from me, and I was indebted to chance alone for stumbling upon his hiding-place. I sat up for the greatest part of several nights successively, and, before he suspected that his treatise was discovered, had completely mastered it. I could now enter upon my own; and that carried me pretty far into the science. This was not done without difficulty. I had not a farthing on earth, nor a friend to give me one: pen, ink, and paper, therefore (in despite of the flippant remark of Lord Orford), were, for the most part, as completely out of my reach as a crown and sceptre. There was, indeed, a resource; but the utmost caution and secrecy were necessary in applying to it. I beat out pieces of leather as smooth as possible, and wrought my problems on them with a blunted awl; for the rest, my memory was tenacious and I could multiply and divide by it to a great extent."

No situation, it will be admitted, could be more unfavourable for study than this; and yet we see how the eager student succeeded in triumphing over its disadvantages, contriving to write and calculate even without paper, pens, or ink, by the aid of a piece of leather and a blunted awl. Where there is a strong determination to attain an object, it is generally sufficient of itself to create the means; and almost any means are sufficient. We are apt to suppose that there is only one way of doing a thing, namely, that in which it is commonly done. But, whenever we have to prove it, we find how rich in resources is Necessity; and how seldom it is that, in the absence of the ordinary instrument, she has not some new invention to supply its place. This is a truth which studious poverty has often had experience of, and been all the better for experiencing; for difficulties so encountered and subdued not only whet ingenuity, but strengthen a man's whole intellectual

and moral character, and fit him for struggles and achievements in after life, from which other spirits less hardily trained turn away in despair.

At last, however, Gifford obtained some alleviation of his extreme penury. He had scarcely, he tells us, known poetry even by name, when some verses, composed by one of his acquaintances, tempted him to try what he could do in the same style, and he succeeded in producing a few rhymes. As successive little incidents inspired his humble muse, he produced several more compositions of a similar description, till he had got together about a dozen of them. "Certainly," says he, "nothing on earth was ever so deplorable;" but, such as they were, they procured him not a little fame among his associates, and he began at last to be sometimes invited to repeat them to other circles. "The repetitions of which I speak," he continues, "were always attended with applause, and sometimes with favours more substantial: little collections were now and then made, and I have received sixpence in an evening. To one who had long lived in the absolute want of money, such a resource seemed a Peruvian mine: I furnished myself by degrees with paper, &c., and, what was of more importance, with books of geometry and of the higher branches of algebra, which I cautiously concealed. Poetry, even at this time, was no amusement of mine: it was subservient to other purposes; and I only had recourse to it when I wanted money for my mathematical pursuits."

But even this resource was soon taken from him. His master, having heard of his verse-making, was so incensed both at what he deemed the idleness of the occupation and especially at some satirical allusions to himself, or his customers, upon which the young poet had unwisely ventured, that he seized upon and carried away all his books and papers, and even strictly prohibited him from ever again repeating a line of his compositions. This

severe stroke was followed by another, which reduced him to utter despair. The master of the free-school, to whom he had never resigned the hope of succeeding, died, and another person was appointed to the situation not much older than Gifford, and who, he says, was certainly not so well qualified for it as himself. "I look back," he proceeds, "on that part of my life which immediately followed this event with little satisfaction; it was a period of gloom, and savage unsociability: by degrees I sunk into a kind of corporeal torpor; or, if roused into activity by the spirit of youth, wasted the exertion in splenetic and vexatious tricks, which alienated the few acquaintances which compassion had yet left me."

His despondency and discontent, however, seem to have gradually given way to the natural buoyancy of his disposition; some evidences of kindly feeling from those around him tended a good deal to mitigate his recklessness; and, especially as the term of his apprenticeship drew towards a close, his former aspirations and hopes began to return to him. But he had spent nearly six years at his uncongenial employment before any decided prospect of deliverance opened upon him. "In this humble and obscure state," he says, "poor beyond the common lot, yet flattering my ambition with day-dreams which perhaps would never have been realized, I was found, in the twentieth year of my age, by Mr. William Cookesley,—a name never to be pronounced by me without veneration. The lamentable doggrel which I have already mentioned, and which had passed from mouth to mouth among people of my own degree, had by some accident or other reached his ear, and given him a curiosity to inquire after the author." Mr. Cookesley, who was a surgeon, and not rich, having learnt Gifford's history from himself, became so much interested in his favour, that he determined to rescue him from his obscurity. "The plan," says Gifford,

"that occurred to him was naturally that which had so often suggested itself to me. There were, indeed, several obstacles to be overcome. My hand-writing was bad, and my language very incorrect; but nothing could slacken the zeal of this excellent man. He procured a few of my poor attempts at rhyme, dispersed them amongst his friends and acquaintance, and, when my name was become somewhat familiar to them, set on foot a subscription for my relief. I still preserve the original paper; its title was not very magnificent, though it exceeded the most sanguine wishes of my heart. It ran thus: 'A subscription for purchasing the remainder of the time of William Gifford, and for enabling him to improve himself in writing and English grammar.' Few contributed more than five shillings, and none went beyond ten and sixpence,—enough, however, was collected to free me from my apprenticeship,* and to maintain me for a few months, during which I assiduously attended the Rev. Thomas Smerdon."

The rest of the story may be very compendiously told. The difficulties of the poor scholar were now over, for his patrons were so much pleased with the progress he made during this short period, that, upon its expiration, they renewed their bounty, and maintained him at school for another year. "Such liberality," he remarks, "was not lost upon me; I grew anxious to make the best return in my power, and I redoubled my diligence. Now that I am sunk into indolence, I look back with some degree of scepticism to the exertions of that period." In two years and two months from what he calls the day of his emancipation, he was pronounced by his master to be fit for the University: and, a small office having been obtained for him by Mr. Cookesley's exertions at Oxford, he was entered of Exeter College, that gentleman undertaking to provide the additional means necessary to enable him to live till he should

* "The sum my master received was six pounds."

take his degree. Mr. Gifford's first patron died before his protégé had time to fulfil the good man's fond anticipations of his future celebrity; but he afterwards found in Lord Grosvenor,* another much more able, though it was impossible that any other could have shown more zeal, to advance his interests. A long and prosperous life, during which he acquired a distinguished name in the literary world, was the ample compensation for the humiliation and hardships of his youth. He was the Editor, for many years, of the 'Quarterly Review,' which was placed under his management at its commencement in 1809; and which attained the most distinguished success in a great degree through his judicious and careful attention to its conduct. The interesting narrative from which we have extracted the preceding pages is prefixed to his English version of Juvenal, the first edition of which appeared in 1802. He had before this acquired great celebrity by his two poetical satires entitled *The Baviad* and *The Mæviad;* and his editions of our old dramatists, Massinger, Ben Jonson, Ford, and Shirley, have also placed his name high as an acute and learned critic. Mr. Gifford died in London on the 31st of December, 1826, in the seventy-first year of his age. It is a beautiful circumstance in his history, and one which shows how a generous act sometimes receives a worldly reward, that he left the bulk of his fortune to the son of his first most kind and disinterested patron, Mr. Cookesley.

Similar in some respects to Gifford's early history is that of his contemporary Thomas Holcroft, the author of 'Hugh Trevor,' and many other well-known productions in light literature. Holcroft has also left us part of a memoir of his own life, the composition of which, however, he commenced too late to live to finish. "How much he had it at heart," says the

* The first Earl, grandfather of the present Marquess of Westminster.

editor of the manuscript (the late Mr. Hazlitt), which was given to the world some years after the death of the author, "may, however, be inferred from the extraordinary pains he then took to make some progress in it. He told his physicians that he did not care what severity of treatment he was subjected to, provided he could live six months longer to complete what he had begun. By dictating a word at a time, he succeeded in bringing it down to his fifteenth year. When the clearness, minuteness, and vividness of what he thus wrote, are compared with the feeble, half-convulsed state in which it was written, it will be difficult to bring a stronger instance of the exertion of resolution and firmness of mind under such circumstances."

Holcroft was born in London in the year 1745, at which time his father worked as a shoemaker and his mother dealt in greens and oysters. His father, who seems to have been a person of unsettled habits, though a well-meaning and upright man, knew very little of his business, to which he had not been regularly bred, and, in spite of the exertions both of himself and his wife, his affairs did not prosper. When young Holcroft was about six years old, the family were suddenly removed from London to a place in Berkshire beyond Ascot Heath, where they remained for about twelve months. Thomas had as yet only been for a short time at a school where children were sent rather to keep them out of harm's way than to learn anything, and to which he used to be carried by an apprentice of his father's. This lad afterwards gained his warmest gratitude by making him a present of the first two books he ever possessed, the one being the History of Parismus and Parismenes, already mentioned as one of Gifford's early literary companions, and the other the Seven Champions of Christendom. It was while they resided in Berkshire that his father began teaching him to read. "The task," he says, "at first I found difficult, till the idea one day

suddenly seized me, of catching all the sounds I had been taught from the arrangement of the letters; and my joy at this discovery was so great, that the recollection of it has never been effaced. After that my progress was so rapid that it astonished my father. He boasted of me to everybody; and, that I might lose no time, the task he set me was eleven chapters a day in the Old Testament. I might, indeed, have deceived my father by skipping some of the chapters, but a dawning regard for truth, aided by the love I had of reading, and the wonderful histories I sometimes found in the Sacred Writings, generally induced me to go through the whole of my task. One day as I was sitting at the gate with my Bible in my hand, a neighbouring farmer, coming to see my father, asked me if I could read the Bible already. I answered, yes; and he desired me to let him hear me. I began at the place where the book was open, read fluently, and afterwards told him, that, if he pleased, he should hear the tenth chapter of Nehemiah. At this he seemed still more amazed, and, wishing to be convinced, bade me read. After listening till he found I could really pronounce the uncouth Hebrew names so much better, and more easily, than he supposed to be within the power of so young a child, he patted my head, gave me a penny, and said I was an uncommon boy. It would be hard to say whether his praise or his gift was most flattering to me. Soon after, my father's apprentice, the kind-hearted Dick, who came backward and forward to my father on his affairs, brought me the two delightful histories I have above mentioned, which were among those then called Chapman's Books. It was scarcely possible for anything to have been more grateful to me than this present. Parismus and Parismenes, with all the adventures detailed in the Seven Champions of Christendom, were soon as familiar to me as my catechism, or the daily prayers I repeated kneeling before my father."

On leaving their house in Berkshire, the family were obliged to adopt a wandering life, the mother turning pedlar, and hawking her wares through the outskirts and neighbourhood of London, while her son trotted after her, and the father, after a vain attempt to obtain some regular employment, in a short time joining the party, who now extended their peregrinations to remote parts of the country. While leading this life, they endured the greatest hardships. Upon one occasion they were so severely pressed, that Thomas was sent to beg from house to house in a village where they happened to be. At length the father managed to buy two or three asses, which he loaded with hampers of apples and pears, and drove about through the country. But this apparent improvement in their circumstances afforded no alleviation to the sufferings of the poor boy. "The bad nourishment I met with," he says, "the cold and wretched manner in which I was clothed, and the excessive weariness I endured in following these animals day after day, and being obliged to drive creatures perhaps still more weary than myself, were miseries much too great, and loaded my little heart with sorrows far too pungent ever to be forgotten. By roads and high-roads were alike to be traversed, but the former far the oftenest, for they were then almost innumerable, and the state of them in winter would scarcely at present be believed." Once, he tells us, he travelled on foot thirty miles in one day; and he was then only a child of about ten years old. During all this time, he made little or no progress in reading.—"I was too much pressed," he says, "by fatigue, hunger, cold, and nakedness." Yet as he continued to repeat his prayers and catechism morning and evening, and to read the Prayer-book and Bible on Sundays, he at least did not forget what he had formerly learned. On one occasion, too, he states, the ballad of Chevy Chace having fallen into his hands, his father, who was very proud of what he conceived to be his son's

talents, and particularly of his memory, set him to get by heart the whole song, by way of task, which he performed, in the midst of his toils, in three days. His father gave him a halfpenny for the achievement, which made him think himself at the time quite a rich man.

When in his eleventh or twelfth year, having been present at the Nottingham races, he was so much struck by the contrast between his own mean and ragged condition, and that of the clean, well-fed, and well-clothed stable-boys, that he determined to try if he could not find a master to engage him in that capacity at Newmarket. After much perseverance, and being turned off after a short trial, first by one master and then by another, from the little knowledge he was found to have of riding, he was at last taken into the service of a person who was considerate enough not to expect him to be a finished groom almost before he could have ever mounted a horse. He very soon began to distinguish himself by his expertness in his new occupation; and the language in which he speaks of his change of circumstances forcibly paints his sense of the miseries from which he had been extricated. Alluding to the hearty meal which he and his companions were wont to make every morning at nine o'clock, after four hours' exercise of their horses, he says, "Nothing, perhaps, can exceed the enjoyment of a stable-boy's breakfast: what, then, may not be said of mine, who had so long been used to suffer hunger, and so seldom found the means of satisfying it?" "For my own part," he adds, "so total and striking was the change which had taken place in my situation, that I could not but feel it very sensibly. I was more conscious of it than most boys would have been, and therefore not a little satisfied. The former part of my life had most of it been spent in turmoil, and often in singular wretchedness. I had been exposed to every want, every weariness, and every

occasion of despondency, except that such poor sufferers become reconciled to, and almost insensible of, suffering; and boyhood and beggary are fortunately not prone to despond. Happy had been the meal where I had enough; rich to me was the rag that kept me warm; and heavenly the pillow, no matter what, or how hard, on which I could lay my head to sleep. Now I was warmly clothed, nay gorgeously; for I was proud of my new livery, and never suspected that there was disgrace in it; I fed voluptuously, not a prince on earth perhaps with half the appetite, and never-failing relish; and, instead of being obliged to drag through the dirt after the most sluggish, obstinate, and despised among our animals, I was mounted on the noblest that the earth contains, had him under my care, and was borne by him over hill and dale, far outstripping the wings of the wind. Was not this a change such as might excite reflection ever in the mind of a boy?"

We must, however, pass over the account which he gives of his life as a stable-boy, interesting as many of the details are into which he enters. During his wanderings through the country with his father, as has been already mentioned, he had scarcely had any opportunity of extending his knowledge of books; the Bible, and such old ballads as he met with by chance on the walls of cottages and ale-houses, constituting all his reading. "Books were not then," he remarks, "as they fortunately are now, great or small, on this subject or on that, to be found in almost every house. A book, except of prayers, or of daily religious use, was scarcely to be seen but among the opulent, or in the possession of the studious; and by the opulent they were often disregarded with a degree of neglect which would now be almost disgraceful." For some time after his arrival at Newmarket, he was not much better off. In about half a year, however, his father followed him to that place, where he at first found a little employment at his old

trade of making shoes; and one of his shopmates, who happened to be fond of books, and to be in possession of a few, occasionally lent young Holcroft a volume from his collection. Among other works, this person put into his hands Gulliver's Travels and the Spectator, with which, the former especially, he was much delighted. He mentions, also, the Whole Duty of Man, the Pilgrim's Progress, and other religious books, as at this time among his chief favourites. As he was one day passing the church, he heard some voices singing, and was immediately seized with a strong desire to learn the art. Having approached the church door, he found the persons within engaged in singing in four parts, under the direction of a Mr. Langham. They asked him to join them, and, his voice and ear being pronounced good, it was agreed that he should be taken into the class; the master offering to give up the entrance-money of five shillings in consideration of his being but a boy, whose wages could not be great, and the others agreeing to let him sing out of their books. "From the little," he proceeds, "I that day learned, and from another lesson or two, I obtained a tolerable conception of striking intervals upwards or downwards, such as the third, the fourth, and the remainder of the octave, the chief feature in which I soon understood; but of course I found most difficulty in the third, sixth, and seventh. Previously, however, to any great progress, I was obliged to purchase 'Arnold's Psalmody;' and, studious over this divine treasure, I passed many a forenoon extended in the hay-loft. My chief, and almost my only difficulty, lay in the impenetrable obscurity of such technical words as were not explained either by their own nature, or by the author in other language. I was illiterate; I knew the language of the vulgar well, but little more. Perhaps no words ever puzzled poor mortal more than I was puzzled by the words *major* and *minor keys*. I think it a duty, which no one

who writes an elementary book ought to neglect, to give a vocabulary of all the words which are not in common use, in the language in which he writes, and to explain them by the simplest terms in that language; or, if that cannot be done, by a clear and easy paraphrase. The hours I spent by myself in mastering whatever belonged to notation, and in learning the intervals, occasioned my progress to be so very different from that of the others, that it excited the admiration of them all; and Mr. Langham, the great man whom I then looked up to, declared it was surprising. If any part was out, I heard it immediately, and often struck the note for them,—getting the start of Mr. Langham. If he should happen to be absent, he said that I could set them all right; so that by this, and the clearness of my voice, I obtained the nickname of 'The sweet singer of Israel.'"

His wages were four pounds a year, and he paid five shillings a quarter to his singing-master; and, upon Mr. Langham offering to give him lessons in arithmetic also for as much more, he agreed to the proposal, and attended him daily for three months. In that time he got so far as Practice and the Rule-of-Three. "Except what I have already related," he says, "these three months, as far as others were concerned, may be truly called my course of education. At the age of two or three and thirty, indeed, when I was endeavouring to acquire the French language, I paid a Monsieur Raymond twenty shillings for a few lessons, but the good he did me was so little that it was money thrown away. At Newmarket I was so intent on studying arithmetic, that for want of better apparatus I have often got an old nail and cast up sums on the paling of the stable-yard." This will remind the reader of Gifford, with his leather for paper, and his blunted awl for a pen.

Holcroft continued at Newmarket for about two years and a half, when he determined to go to London once more to join his father, who now kept a cobbler's stall in

South Audley Street. "My mind," he says, "having its own somewhat peculiar bias, circumstances had rather concurred to disgust me than to invite my stay. I despised my companions for the grossness of their ideas, and the total absence of every pursuit in which the mind appeared to have any share. It was even with sneers of contempt that they saw me intent on acquiring some small portion of knowledge, so that I was far from having any prompter either as a friend or a rival." He was at this time nearly sixteen. For some years he continued to make shoes with his father, and at last became an able workman. But he grew every day fonder of reading, and, whenever he had a shilling to spare, spent it in purchasing books. In 1765, having married, he attempted to open a school for teaching children to read at Liverpool, but was obliged to abandon the project in about a year, when he returned to town, and resumed his trade of a shoemaker. Beside his dislike to this occupation, however, on other accounts, it brought back an asthmatic complaint he had had when a boy, and every consideration made him resolve to endeavour to escape from it. Even at this time he had become a writer for the newspapers, the editor of the 'Whitehall Evening Post' giving him five shillings a column for some essays which he sent to that journal. He again attempted to open a school in the neighbourhood of London; but after living for three months on potatoes and butter-milk, and obtaining only one scholar, he gave up the experiment, and returned to the heart of the town. Having acquired some notions of elocution at a debating club which he had been in the habit of attending, he next thought of going on the stage, and obtained an engagement from the manager of the Dublin theatre, at a poor salary, which was very ill paid. He was so ill treated, indeed, in this situation, that he was obliged to leave it in about half a year. He then joined a strolling company in the north of England, and wandered

about as an itinerant actor for seven years, during which time he suffered a great deal of misery, and was often reduced almost to starving. In the midst of all his sufferings, however, he retained his love of books, and had made himself extensively conversant with English literature. At last, in the end of the year 1777, he came back to London, and, by means of an introduction to Mr. Sheridan, obtained an engagement in a subordinate capacity at Drury Lane. He had just before this, as a desperate resource, sat down to compose a farce, which he called 'The Crisis,' and this turned out the commencement of a busy and extended literary career. The farce, although only acted once, was well received, and it soon encouraged him to new efforts of the same kind; yet he continued for many years involved in difficulties, from which it required all his exertions to extricate himself. The remainder of Mr. Holcroft's history, with the exception of a short but stormy period, during which he was subjected to very severe usage on account of certain political opinions which he was supposed to hold, is merely that of a life of authorship. He never became a good actor, and after some time dedicated himself entirely to literary occupation. His industry in his new profession is abundantly evidenced by the long list of his works, which comprise several of high talent and established popularity. In his maturer years, beside many other acquirements, he made himself master of the French and German languages, from both of which he executed several well-known translations.

Mr. Holcroft died in 1809. His life is in many respects admirably calculated to answer the design which he had in view, he tells us, in writing the account of the early part of it, namely,—"to excite an ardent emulation in the breasts of youthful readers, by showing them how difficulties may be endured, how they may be overcome, and how they may at last contribute, as a school of instruction, to bring forth hidden talent."

CHAPTER II.

ENJOYMENT ATTENDING THE PURSUIT OF KNOWLEDGE. PURSUIT OF KNOWLEDGE BY PERSONS OF RANK OR WEALTH:—DEMOCRITUS; ANAXAGORAS; NICEPHORUS ALPHERY; MARCUS AURELIUS; JULIAN; CHARLEMAGNE; ALFRED; JAMES I. OF SCOTLAND; ELIZABETH; ALPHONSO X.

Many of the examples we have given show that the Pursuit of Knowledge does much more than merely exercise and enrich the intellect. The moral habits which it has a tendency to create and foster form one of its chief recommendations. Knowledge is, essentially and directly, power; but it is also, indirectly, virtue. And this it is in two ways. It can hardly be acquired without the exertion of several moral qualities of high value; and, having been acquired, it nurtures tastes, and supplies sources of enjoyment, admirably adapted to withdraw the mind from unprofitable and corrupting pleasures. Some distinguished scholars, no doubt, have been bad men; but we cannot tell how much worse they might have been but for their love of learning, which, to the extent it did operate upon their characters, could not have been otherwise than beneficial. A genuine relish for intellectual enjoyments is naturally as inconsistent with a devotion to the coarser gratifications of sense as the habit of assiduous study is with that dissipation of time, of thought, and of faculty, which a life of vicious pleasure implies.

But Knowledge is also happiness, as well as power and virtue;—happiness both in the acquisition and in the possession. And, were the pursuit of it nothing better than a mere amusement, it would deserve the preference over all other amusements on many accounts. Of these, indeed, the chief is, that it must almost of

necessity become something better than an amusement, —must invigorate the mind as well as entertain it, and refine and elevate the character while it supplies to listlessness and weariness their most agreeable excitement and relaxation. But, omitting this consideration, it is still of all amusements the best, for other reasons. So far from losing any part of its zest with time, the longer it is known the better it is loved. There is no other pastime that can be compared with it in variety. Even to him who has been longest conversant with it, it has still as much novelty to offer as at first. It may be resorted to by all, in all circumstances:—by both sexes; by the young and the old; in town or in the country; by him who has only his stolen half hour to give to it, and by him who can allow it nearly his whole day; in company with others, or in solitude, which it converts into the most delightful society. Above all, it is the cheapest of all amusements, and consequently the most universally accessible. A book is emphatically the poor man's luxury, for it is of all luxuries that which can be obtained at the least cost. By means of itinerating libraries for the country, and stationary collections for each of our larger towns, almost every individual of the population might be enabled to secure access for himself to an inexhaustible store of intellectual amusement and instruction, at an expense which even the poorest would scarcely feel.

As yet, however, these advantages have been chiefly in the possession of the middle classes, to whom they have been a source not more of enjoyment than of intelligence and influence. Among the highest orders of society, the very cheapness of literary pleasures has probably had the effect of making them to be less in fashion than others of which wealth can command a more exclusive enjoyment. Even such distinction as eminence in intellectual pursuits can confer must be shared with many of obscure birth and low station, and

on that account alone has doubtless seemed often the less worthy of ambition to those who were already raised above the crowd by the accidents of fortune. Yet, whatever enjoyment there may really be in such pursuits will not, of course, be the less to any one because he happens to be a person of wealth or rank. On the contrary, these advantages are perhaps on no other account more valuable than for the power which they give their possessor of prosecuting the work of mental cultivation to a greater extent than others. He can command, if he chooses, a degree of leisure, and freedom from interruption, greatly exceeding what the generality of men enjoy. Others have seldom more than the mere fragments of the day to give to study, after the bulk of it has been consumed in procuring merely the bread that perisheth; he may make literature and philosophy the vocation of his life. To be enabled to do this, or to do it only in small part, many have willingly embraced comparative poverty in preference to riches. Even in modern times, Alfieri, the great Italian dramatist, gave up his estate to his sister, that he might devote himself the more freely to his poetical studies. Among the philosophers of the ancient world, some are said to have spontaneously disencumbered themselves of their inheritances, that the cares of managing their property might not interrupt their philosophic pursuits. Crates, Thales, Democritus, Anaxagoras are particularly mentioned as having made this sacrifice. But in those days, it is to be remembered, knowledge was chiefly to be obtained by travelling into foreign countries, and those who sought it were therefore obliged, before setting out on the search, either to relinquish altogether the possessions they had at home, or to leave them in charge of trustees, who generally took advantage of their stewardship to embezzle or squander them. Doubtless no one of the celebrated persons we have enumerated would have thrown away

his patrimony, if he could have retained it with as little inconvenience as such an incumbrance can possibly occasion a philosopher in our own times. The only worldly imprudence even of which they can be fairly accused is that of having preferred knowledge to wealth when it was necessary to make a choice between the two; or that of having allowed themselves to be too easily cheated of the latter, in their enthusiastic devotion to the former. Bayle, who had himself a strong sympathy with this love of a quiet in preference to a splendid life, states the matter correctly in the case of Democritus, when he says, in his article on that great father of natural philosophy:—"The spirit of a great traveller reigned in him; he journeyed to the heart of India in quest of the riches of learning, and bestowed but little thought on those other treasures which he had almost at his door." Anaxagoras, in like manner, although he did not travel so far from home as Democritus, still owed the loss of his property to his being obliged to leave it in the hands of others. This ingenious but somewhat fanciful speculator, the master of Socrates and Euripides, and the honoured friend of Pericles, was a native of Clazomenæ in Ionia, and the descendant of noble and wealthy ancestors, whose lands he inherited; but, determining to devote his life to philosophy, he did not hesitate, when only about twenty years of age, to bid adieu to his fair possessions, and, crossing the Ægean, to repair to Athens, where he continued to pursue his studies while his estate was running to waste, and at last maintained himself by giving lessons to others. Cicero mentions Anaxagoras, along with Pythagoras and Democritus, as having declined those public honours, and that share in the management of affairs, to which his birth and qualifications entitled him to aspire, "for the sake," as he expresses it, "of tranquillity, and for the sake of the sweetness of knowledge, than which nothing is to man more delightful"

—*propter tranquillitatem, et propter ipsius scientiæ suavitatem, qua nihil est hominibus jucundius.** This is the testimony of one who had himself tasted the charms of political power as well as those of philosophy.

We may here notice the singular story of MIKEPHER (or NICEPHORUS) ALPHERY, as related in the Biographia Britannica. Alphery was born in Russia about the close of the sixteenth century, of the family of the Czars. He was, we suppose, of the ancient race of Ruric, which, after occupying the throne for nearly eight centuries, gave place to a new dynasty on the death of Feodore Iwanovitch, commonly called Feodore I., in 1598. This event, which was immediately followed by the usurpation of Boris Godunow, after he had caused Feodore's only brother Demetrius, the heir to the crown, to be assassinated, was the occasion of protracted troubles to Russia. It appears to have been about the commencement of these convulsions that Alphery and his two brothers were sent by their friends for safety to England, and intrusted to the care of a merchant, connected by commercial relations with their native country. Their protector gave them a liberal education, and at the proper age they were all entered of the University of Oxford. Soon after this, however, two of them were attacked by small pox and died. Nicephorus, the survivor, now resolved to take orders in the English church, and accordingly, having been ordained, he was appointed in 1618 to the living of Wooley, in Huntingdonshire, the income of which was barely sufficient to afford him a maintenance. By this time the throne of his ancestors was in the possession of Michael Fedrowitch Romanow, who was the son of a patriarch of the Greek church, and had, in 1613, when only sixteen years of age, obtained the imperial crown, which has ever since been worn by his descendants. Thus, while on the one hand the church had received into her

* De Oratore, lib. iii.

ranks the heir of an empire, that empire on the other hand received a sovereign from the church. The disturbances that had so long distracted Russia, however, were not settled by the accession of Michael; and it is asserted that subsequently to this period Nicephorus was actually twice invited to return to his native country, and put himself at the head of a powerful party who desired to place him on the throne. But, with a want of ambition which many will despise, although its wisdom might perhaps be defended, he preferred on both occasions his humble parsonage to this splendid temptation. Never having obtained any additional preferment, he long made himself happy by the discharge of his duties in the lowly condition he had embraced; and his meek spirit was probably but rarely troubled even by a thought of the exalted station which he might possibly have attained. After settling at Wooley he married, and had a family. Alphery was not destined, however, even by his relinquishment of the rights of his birth, to escape the storms of political commotion; for on the ascendancy of the republican party after the civil wars he was deprived of his living, and, with his wife and children, compelled to wander about for some time without a home; nor did he recover his benefice till the Restoration. By this time the infirmities of advanced age had left him but little strength for the performance of his clerical duties; and, leaving his parish in charge of a curate, he soon after retired to Hammersmith, to the house of one of his sons who was settled there. In this retreat he lived for some years, unnoticed, but not unhappy; and when his death took place at last, his singular fortunes had been so much forgotten by all the world that nobody has recorded the date of the event.

We do not read of any remarkable acquirements in literature made by this individual; but, if moderation of desires be a quality of the philosophic spirit, he is en-

titled to be regarded as no ordinary philosopher. Many others, however, might be enumerated, who even on a throne have cultivated science and letters, and intermingled the occupations of study with those of sovereignty. We may mention among the Roman emperors the excellent Marcus Aurelius, a prince who, with some



COIN OF AURELIUS.

failings, manifested many virtues that have rarely adorned in the same degree either a public or a private station. Called to the imperial dignity contrary to his own wishes, Aurelius, who had been a philosopher before his exaltation, remained the same in character, and as far as possible in habits, after he became the master of the world; and he is at least one instance of a naturally good disposition which power the most unbounded was unable to corrupt. To our common notions, or prejudices, his giving his attendance, when nearly sixty years of age, to a course of philosophical lectures may seem to savour something of pedantic display: but kings have often been worse employed; and it is at any rate delightful to find this good and enlightened emperor, after his victorious campaigns, repairing, ere he returned home to receive the congratulations of his impatient Romans, to the mother-city of philosophy, learning, art, and freedom, the subjugated but still illustrious Athens, and there examining the trophies of her old glory, mixing in her religious processions and ceremonies,

rebuilding and re-endowing her schools, bestowing new honours and privileges on the teachers, and neglecting nothing that could make her once more the metropolis of the world of letters. Marcus Aurelius is said to have written several books; but only one work, commonly known as his *Meditations*, composed in Greek, has come down to us. How happy would nations be, this prince was wont to exclaim in the words of Plato, if the philosophers were their kings, or their kings were philosophers! And he afforded in himself, equally able as was his administration of affairs at home and abroad, in peace and in war, at least one splendid exemplification of the truth of his favourite remark—which yet might not be found to hold generally good, unless philosophy were to include, as it did in him, practice as well as speculation. The Emperor JULIAN, in a later age, though perhaps equalling Marcus Aurelius in literary talents and accomplishments, and endowed also with many great qualities by nature, does not exhibit to us quite so beautiful a picture of philosophy on a throne. He had neither the simplicity, sincerity, and perfect truthfulness of his predecessor's moral character, nor the unimpassioned sagacity and clearness of vision which distinguished his understanding; and he is chargeable indeed with acting in many respects in a spirit of affectation and blind prejudice, anything but creditable to a philosopher. Yet, during his short reign of little more than a year and a half, Julian proved himself both an able monarch and a man possessed of great virtues. In war his valour was only equalled by his clemency. An enemy to all luxury and excess, he did every thing in his power, by his authority and his example, to repress the growing extravagances and debaucheries of the times, and abolished many customs of the imperial court which he considered only occasions of expense and effeminate indulgence. Much of his time was spent in conversing with learned men, much in solitary study;

indeed, from a very early hour in the night till morning was generally devoted by him, even during his campaigns, to reading and writing. He has left several works, all written in Greek, which was then the language of the court.

In a more recent but much darker age, we find literature cultivated with zeal by the emperor CHARLEMAGNE, when there were few other individuals to whom it was at all an object of attention throughout his vast dominions. This great conqueror, whose life was spent in almost incessant wars, was yet wont to give whatever leisure he could spare to reading, writing, and the converse of the learned; and several of his letters and other compositions are still extant. Even when confined to bed by sickness, he was accustomed to amuse himself, we are told by his biographer and contemporary Eginhard, in attempting to imitate the elaborately ornamented characters common in the books of that age,—a statement which has been erroneously interpreted as importing that all his progress in the art of writing consisted merely in these ineffectual essays. It can scarcely be doubted, from other circumstances, that he was familiar with this art. The greatest service, however, which Charlemagne rendered to learning was his munificent patronage of its professors, and the readiness and zeal with which he lent himself to various schemes for its restoration and diffusion. The University of Paris is commonly supposed to have sprung from a seminary which he established in his palace (hence called the Palatine school), and in the institution of which his principal adviser and assistant was our countryman, the able and accomplished Alcuin. This school appears to have been opened about the year 780, while its projector was yet in the very midst of his wars. While letters, long forgotten both in courts and general society, were thus enjoying the protection of Charlemagne in the West, the famous Haroun Al Raschid (or the Just),

whose name the Arabian Nights' Entertainments have made so familiar to every reader, and whose extensive dominions entitled him to be regarded as the proper Emperor of the East, was affording them equal encouragement in that quarter of the globe. Haroun was himself, indeed, an excellent poet, and distinguished for his proficiency in various branches of learning. But at this time the Mahometan world was very considerably ahead of the nations of Christendom in civilization and the knowledge of the arts. The two great potentates we have mentioned, between whom so large a portion of the earth was divided, are recorded to have corresponded with each other; and in the year 807 an ambassador from the Caliph arrived in France, bringing with him various presents for Charlemagne, among them a clepsydra, or water-clock, which excited especial admiration as a contrivance beyond anything which ingenuity had yet invented in Europe. Another of Haroun's presents was a set of chess-men, some of which are still preserved in the Royal Library at Paris. Charlemagne reigned from the year 768 to 814, when he died at the age of seventy-one; and Haroun Al Raschid died at the age of forty-seven in 809, after a reign of twenty-three years.

But our own ALFRED, whose attainments in learning, made in the latter portion of a short and very busy life, we have already briefly noticed, does much more honour by his literary performances to the ninth century than Charlemagne and the Caliph Haroun do to the eighth. Alfred, born in the year 849, succeeded to the crown in 871, and his reign extended to the close of the century. Even the unusual lateness of the period at which his acquaintance with books commenced was but the least of the untoward circumstances with which this wonderful man had to contend in his pursuit of knowledge. Born, as he was, the son of a king, how scanty were the means of education of which he had it in his power to avail himself, compared with those which, in our happier

days, are within the reach of the poorest peasant! In that age it demanded the price of a goodly estate to purchase a book; and, in England especially, teachers were so scarce, that Alfred, so long as he continued merely a prince dependent upon his father or his elder brothers, actually seems to have been without the requisite resources to procure their services. Nothing, as his biographer, Asser, informs us, was a more frequent subject of regret with him, than that, during the only time of his life when he had either health or leisure for study, he had thus been left utterly without the means of obtaining instruction. For as soon almost as he had passed his boyhood, he was obliged to engage in active duty as a soldier; and the incessant toils of a military life, in the course of which he is recorded to have fought no fewer than fifty battles, as well as to have undergone a succession of hardships and sufferings under which an ordinary mind would have broken down in despair, consumed not a few of the best of his succeeding years. And even after he succeeded to the throne, when we consider that, in addition to the extensive literary labours which he accomplished, he not only attended to his multifarious public duties with a punctuality that has never been surpassed, but notwithstanding his harassing bodily ailments, signalized himself by his prowess and dexterity in every manly exercise, we may well ask by what mysterious art did he find time for all this variety of occupation? The answer is, that he found time by never losing it. Time is the only gift or commodity of which every man who lives has just the same share. The passing day is exactly of the same dimensions to each of us, and by no contrivance can any one of us extend its duration by so much as a minute or a second. It is not like a sum of money, which we can employ in trade, or put out to interest, and thereby add to or multiply its amount. Its amount is unalterable. We cannot "make it breed;" we cannot even keep it by us.

Whether we will or no, we must spend it; and all our power over it, therefore, consists in the manner in which we spend it. Part with it we must; but we may give it either for something, or for nothing. Its mode of escaping from us, however, being very subtle and silent, we are exceedingly apt, because we do not feel it passing out of our hands like so much told coin, to forget that we are parting with it at all; and thus, from mere heedlessness, the precious possession is allowed to flow away as if it were a thing of no value. The first and principal rule, therefore, in regard to the economizing and right employment of time, is to habituate ourselves to watch it. Alfred knew this well; and he adopted a method of his own to measure the passing hours, in his want of those more artificial time-pieces which we possess. Having made his chaplains, as Asser in his simple narrative informs us, procure the necessary quantity of wax, he ordered six candles to be prepared, each of twelve inches long, which he had found would together burn for four and twenty hours. Having marked the inches on them, therefore, he ordered that they should be lighted in succession, and each three inches that were consumed he considered as recording the flight of an hour. "But finding," continues his biographer, "that the candles burned away more quickly at one time than at another, on account of the rushing violence of the winds, which sometimes would blow night and day without intermission through the doors and windows, the numerous chinks in the walls, or the slender covering of the tents, he bethought him how he might prevent this inconvenience; and, having contrived artfully and wisely, he ordered that a lanthorn should be fairly fashioned of wood and horn; for white horn, when scraped thin. allows the light to pass through even like glass. The candle, therefore, being placed in the lanthorn, thus wonderfully constructed, as we have said, of wood and horn, was both protected from the wind, and

shone during the night as luminously without as within." Every heart will acknowledge that there is something not a little interesting, and even touching, in these homely details, which paint to us so graphically the poor accommodations of every kind in the midst of which Alfred had to pursue his studies, and the humble matters with which his great mind was often obliged to occupy itself in contriving the means of gratifying its noble aspirations. This illustrious man, indeed, seems almost to have lifted himself quite above the tyranny of circumstances; realizing, in the most disadvantageous, nearly all that could be expected or desired in the most favourable. The difficulties with which he had to contend, in truth, formed the very soil out of which no small portion of his greatness grew. Among kings he is not only the Great, but the very greatest. If we look merely to his zeal and services in behalf of literature, it is impossible to name any royal personage that can be compared with him either in classic antiquity or in modern times. A genuine love for letters, and a proficiency in them, in the possessor of a throne, is worthy of our admiration, in whatever age or country the phenomenon may be recorded to have been witnessed; because it must always be considered as a striking example of a triumph over seductions that are generally, of all others, found the most difficult to resist, and have, accordingly, been of all others the most seldom resisted. But of the other learned kings of whom we read in history, some were literary in a literary age; others, naturally unfitted for the more active duties of their station, took to philosophy, or pedantry, as a refuge from insignificance; some had caught the love and the habit of study before they had mounted a throne, or had dreamed of mounting one; above all, most, if not all of them, had been carefully educated and trained to letters in their youth. But it is told only of Alfred, that, without an example to look to, without even the advantages

of the very scantiest education, in an unlearned age, and a still more unlearned country, he, who had been only a soldier from his youth upwards, withdrew himself of his own accord from the rude and merely sensual enjoyments of all his predecessors and all his contemporaries, to devote himself to intellectual pursuits, and to seek to intertwine with the martial laurels that already bound his brow the more honourable wreath of literary distinction.

Of the royal personages of our own country who have distinguished themselves by their love and cultivation of letters, the most eminent, next to Alfred, is JAMES I. of Scotland, whose poem, entitled the *King's Quhair*, composed by him during his imprisonment in Windsor Castle, we have already mentioned. James was born in 1394, but, having been captured at sea on his way to France by a vessel of the King of England in 1405, was detained in that country, for the greater part of the time in close confinement, till his thirtieth year; after which, having been allowed to return to Scotland, he reigned for thirteen years, and was at last cruelly assassinated in the Carthusian monastery at Perth, on the 20th of February, 1437, by a faction of his nobles, whom his attempted reforms dissatisfied. Literature had been the principal solace of James's long imprisonment, and he brought with him to the throne the tastes which he had acquired in his exile. He certainly contributed very essentially, even during his short reign, to promote the civilization of his native country. Nothing can exceed the warmth of the admiration with which all the old historians speak of his genius and accomplishments, and of the effect which his example had in diffusing among his people that spirit of literary cultivation, and love for all elegant and intellectual accomplishments, by which he was himself distinguished. He was a proficient, we are told, in the Latin language, and, some authorities add, even in the Greek, although this last statement must be

regarded as apocryphal, all things considered. His mastery over his native tongue was, at all events, his most remarkable endowment. The songs and other metrical pieces which he composed in the Scottish dialect, though now probably all lost, are said to have long continued to be the delight of all classes of his countrymen; and to their influence we are, in all probability, to trace much of that universal sensibility to poetry which has ever since distinguished the Scottish peasantry, and which has displayed itself in the creation of a body of traditionary verse, of wonderful extent and richness. Give me, some one has said, the making of a people's ballads, and I care not who has the making of their laws. If the opinion conveyed in this remark be correct, James I. perhaps influenced the character of his countrymen quite as much as any of their legislators. Some authorities also claim for this prince the honour of being the father of the peculiar music of his country. He is recorded by our old chroniclers to have been eminently skilled both in vocal and instrumental music, and to have performed on no less than eight different instruments, the harp being the one on which he most excelled. At any rate, from the time of James we may date the proper commencement of the literature of Scotland, to which, indeed, he seems to have also given not a little of the peculiar character that long distinguished it. His own writings, as has been stated, were poetical compositions, in the style that had been so recently introduced by Chaucer, whom, in his *Quhair*, he expressly mentions as his master. The *Quhair* is an elegant poem, displaying considerable descriptive talent; but the tradition respecting some of James's more popular poetical compositions is that they evinced powers of humour of the very highest order. Before his day Fordun had written, in Latin prose, his chronicle of Scottish kings, and Barbour his metrical work in the vernacular tongue entitled *The Bruce;* but these, not-

withstanding some passages of vivid description in the latter, which certainly give its author considerable pre-eminence among the class to which he belongs, were merely such works as have been produced among every people having the use of letters, as soon as they have acquired for themselves what may be called a history; and indicate not so much that a national literature has taken root among them, as simply that they have reached a certain antiquity, and have a past national existence to look back upon. That which alone we can properly call the authorship of Scotland commences with the works of King James, and is continued by those of Dunbar, Gavin Douglas, and Sir David Lyndsay, who may all in some sort be considered as his imitators, or at least as having, like himself, taken their inspiration from that new-born poetry of England with which he, there can be little doubt, was the first to make his countrymen acquainted.

Few kings, therefore, in spite of the failure of many of his projected political reforms, have done more for their subjects than James did for his. He regenerated them by means more powerful than any merely political contrivances, when he exhibited before them for the first time the graces and attractions of intellectual cultivation, and gradually seduced them by the charm of his example to the love of the arts and elegancies of civilized life. Laws and institutions are, after all, in themselves, but the dead skeleton of society, and can only derive their life and efficiency from the spirit breathed into them by the character and moral condition of the people. They are the body; this is the animating soul. In giving, therefore, to his countrymen the first impulses of literary refinement, he gave them something better even than good laws, because it was that which, while it would eventually enable them to secure good laws for themselves, at the same time could alone fit them for their enjoyment. His life, not less than his death, was a sa-

crifice to his zeal for their improvement; for, with tastes and habits that tended to separate him so completely from his subjects, his residence, even as a king, in Scotland must have been felt by him as far more truly exile than even his previous imprisonment. Yet we have no reason to think that, although his days were spent first in durance abroad, and then in worse than durance at home, he ever indulged in any weak or undutiful murmuring at his fate. On the contrary, we gather from all that is related of him, that, during the short period of his life when he was permitted to mix with the world, he showed himself of a cheerful and even joyous spirit, and found the means of making himself happy even in the midst of the hardest fortune that was dealt out to him. With his intellectual endowments and his love of letters, he had sources of happiness which few in his station have ever enjoyed, and these were blessings which the vicissitudes of outward fortune had but little power to affect.

We might add several other names to the list of learned kings, even from the monarchs of our own country. HENRY I., in the early part of the twelfth century, obtained the surname of *Beauclerc*, or the Learned, from his proficiency in the literature of the times. During the sixteenth century, classical and theological erudition was so much in fashion, that persons of the very highest rank, and of both sexes, very generally received what is called a learned education. It is related of the emperor Charles V., that, having been upon one occasion addressed by an ambassador in a Latin oration, he was so much affected at finding himself unable perfectly to follow the speaker, that he publicly reproached himself for his inattention, when a boy, to the instructions of his tutor,* who, he remarked, had often warned him, that a day would come

* The same who afterwards became Pope, under the title of Adrian VI.—See *ante*, vol. i. p. 274.

when he would regret his negligence. So universally in those days was this sort of learning expected in crowned heads. Accordingly we find almost all our sovereigns of that age proficients in the ancient languages, and adepts in polemical divinity. Henry VIII. disputed,



EDWARD VI.

through the press, with Luther, in Latin. His son, Edward VI., had he lived, would probably have given proofs of still greater accomplishments in the same department of scholarship. One of his tutors was Sir

John Cheke, of whom Milton speaks, in a well-known sonnet, as having taught "Cambridge, and King Edward, Greek;" and it is a curious illustration of the times, that this learned individual was soon after selected to fill the office of Secretary of State. Queen ELIZABETH, we need hardly remark, is famous as a



ELIZABETH.

learned princess. She also, like her royal predecessor, King Alfred, completed an English translation of Boethius's 'Consolations of Philosophy'—a work which, in addition to having been thus rendered into the vernacular tongue by two of the greatest of our

monarchs, had the honour of receiving the same service from Chaucer, the father of our poetry.* Elizabeth's successor, JAMES, had more learning than good sense, and was a pedant rather than a scholar; but with less learning, he certainly would not have been a wiser king. He is the instance, however, that has perhaps contributed more than any other to confirm the common prejudice, that a taste for letters is, after all, no very desirable quality in the possessor of a throne. If it be meant that literary kings have generally been bad kings, the notion is certainly not borne out by the facts of history. It may be asserted with much greater truth that, in all of those who, notwithstanding their scholarship, have shown themselves unworthy of their high station, that scholarship has yet been a redeeming quality, both in itself, and in its effects. If, again, all that is meant be only that learning has some tendency to become pedantic on a throne, this may be admitted; for it is a natural consequence of the possession being so unusual: but even this result, where it has happened, has, in by far the majority of cases, formed but a very trifling drawback upon the good with which it was connected. James certainly has not gained much credit to his name by his authorship; though it deserves to be remarked, that it is posterity that has been least indulgent to his pretensions. In his own day his learning procured him great admiration, not only from the mere courtly flatterers of the time, but from many of its most distinguished scholars—for evidence of which, we need go no farther than to the dedication of their work addressed to him by the authors of our admirable translation of the Bible, and still commonly printed at its head. The natural character of the man, the species and quality of the learning which he had acquired, and

* The original copy of Queen Elizabeth's translation of Boethius, partly in her majesty's hand-writing, and partly in that of her secretary, was discovered, some years ago, in the State Paper Office.

above all the spirit of the age, had more share in making James the pedant that he was than any disadvantage under which his station placed him.

Another name, which is sometimes quoted as that of a king to whom learning was a misfortune rather than a blessing, is that of the celebrated ALPHONSO X., king of Castile and Leon, commonly called the *Wise.* This prince, who lived in the thirteenth century, was certainly unlucky in his schemes of political ambition; and the vain attempt he made to obtain possession of the imperial crown involved him in a series of calamities, and eventually led to his dethronement. But it does not appear that his literary and scientific acquirements, so extraordinary for his age, had anything to do in occasioning the errors to which he owed his ruin, or that, with less learning, he would have been either more prudent, or more fortunate. As it was, Alphonso, notwithstanding the troubles in which his reign was passed, conferred such services, both upon his own country and upon the world at large, as few royal names have to boast of. Spain owes to him, not only her earliest national history and translation of the Scriptures, but the restoration of her principal university, the introduction of the vernacular tongue in public proceedings and documents, and the promulgation of an admirable code of laws; and science is indebted to this monarch for the celebrated astronomical tables known by his name, the earliest which were compiled subsequently to those given in the Almagest of Ptolemy, who flourished in the second century. According to some accounts, Alphonso spent the large sum of 400,000 crowns on the preparation of these tables, in which he was assisted by others of the most learned astronomers of the time. They went through several editions, even after the invention of printing, and continued, indeed, to be generally used by astronomers till the commencement of the sixteenth century.

CHAPTER III.

PETER THE GREAT, CZAR OF RUSSIA.

BUT the pursuit of knowledge is not necessarily confined to the study of books; and, therefore, although we pass over many other names that might be here introduced, we must not omit that of a sovereign who distinguished himself by his ardour in this pursuit in a variety of ways, and was in all respects one of the most extraordinary men that ever lived,—the Czar PETER I. of Russia.

Peter was born in 1672, and at ten years of age found himself in nominal possession of the throne; although, for some time, all the actual power of the state remained in the hands of his sister, the princess Sophia, who was about five years older than himself. But his boyhood was scarcely expired, when he gave proof of the energy of his character by ridding himself of this domination; and in 1689 the princess was already removed from the government, and immured in a monastery. From this moment the young Czar, now absolute in reality as well as in name, directed his whole efforts to the most extraordinary enterprise in which a sovereign ever engaged; being nothing less than to change entirely the most settled habits and prejudices of his subjects, and not so much to reform them, as to transform them, almost by main force, from barbarians into a civilized people. For the Russians at this time—not much more than a century and a half ago—were, in truth, little better than a nation of savages. Nay, Peter himself

was born and reared a savage; and to his last days the passions and propensities of his original condition remained strong in his nature. It speaks the more for his wonderful genius that, throughout his whole history, he forces us to feel that we are reading the adventures of the chief of a barbarous country, struggling to civilize himself as well as his people. And undoubtedly we do not follow his progress with the less interest on that account. Nothing, in fact, in his proceedings or his character so much engages our curiosity, as to watch the astonishment with which his own ignorance was struck on the first view of those arts of civilized life which he was so anxious to introduce among his less ambitious, but hardly more ignorant, subjects. It is exactly the case of a strong-minded and enterprising leader of some tribe of wild Americans or South Sea islanders, setting out to see with his own eyes the wonders of those distant lands of which his white visitors have told him, and, after all, viewing the scenes which civilization presents to him with an intoxication of surprise, which shows how imperfectly even his excited fancy had anticipated their actual nature.

But, however he was at first struck with what he beheld, Peter did not continue long lost in mere amazement. The story which is told of the occasion which awakened him to the ambition of creating a Russian navy is very illustrative of his character. While looking about one day among some old stores and other neglected effects, he chanced to cast his eye upon the hulk of a small English sloop, with its sailing tackle, lying among the rest of the lumber, and fast going to decay. This vessel had been imported many years before by his father, Alexis Michelovitch, also a prince of distinguished talents, and one who had nourished many schemes for the regeneration of his country; but it had long been forgotten by everybody, as well as the object which it was designed to promote. No sooner,

however, was it observed by Peter than it fixed his attention. He made inquiries of some of the foreigners by whom he was surrounded as to the use of the mast and sails, even the general purposes of which he did not know; and the explanations which he received made him look on the old hulk with new interest. It immediately became, in his imagination, the germ of a magnificent national marine; and he could take no rest till he had made arrangements for having it repaired and set afloat. With some difficulty the Dutch pilot was found out whom Alexis had procured at the same time with the sloop to teach his subjects the method of managing it; the man, like the vessel of which he was to have the charge, had long been forgotten by all the world. Once more, however, brought out of his obscurity, he soon refitted the sloop; and the Czar was gratified beyond measure by at length beholding it, with its mast replaced and its sails in order, moving on its proper element. Delighted as he was, he went himself on board, and was not long before he became a sufficiently expert seaman to take the place of his Dutch pilot. For several years after this his chief attention was given to maritime affairs; although his first ships were all of foreign construction, and it was a considerable time before any issued from his own docks. From so small a beginning as has been described, Russia has since become one of the great naval powers of the world.*

* The most detailed version we have met with of the story told in the text is one preserved among the MSS. of Sir Hans Sloane, in the British Museum (No. 3168). It appears to have been written shortly after the death of Peter the Great, and by a person who was either a native of Russia or had resided in that country. According to this authority the incident took place in the flax-yard at Ishmaeloff, an old seat of the royal family near Moscow. The writer gives us also an account of a great naval show, at which he himself was present, in honour of this celebrated vessel, which took place by the emperor's command at St. Petersburg, on the 12th of August, 1723. On this occasion the sloop, or ship's boat, as it is here called, having

But the most extraordinary of the plans which Peter adopted in order to obtain an acquaintance with the arts of civilized life, was that which he put in execution in 1697, when he set out in the suite of his own ambassador to visit the other countries of Europe. On this occasion, passing through Prussia, he directed his course to Holland, and at last arrived at the city of Amsterdam. His embassy was here received by the government of the United Provinces with all manner of honour and distinction; but he himself refused to be recognized in any other character than that of a private individual. The first days of his visit were spent in perambulating the different streets of the city, the various wonders of which were probably never viewed by any eye with more astonishment and gratification than they excited in this illustrious stranger. The whole scene was nearly as new to him, and as much beyond anything by which he had ever before been surrounded, as if he had come from another world. The different arts and trades which he saw exercised, and the productions of which met him, wherever he turned, in such surprising profusion, were all attentively examined. But what especially attracted his attention was the great East India dockyard in the village of Saardam (situated a few miles from Amsterdam), which was then the principal establishment of this description in Holland. Here he actually took the singular resolution of entering himself as a working carpenter; and accordingly, giving in to the superin-

been repaired and beautified, was received by about 200 yachts, and, having advanced to the harbour attended by that numerous convoy, was then saluted by a general volley from the twenty-two men-of-war, which might be considered as forming its progeny. The emperor, of course, was present, and the day was altogether one of the greatest festivals that had been known in Petersburg. "A few days after," it is added, "the boat was brought to Petersburg, and laid up in the castle, where she is to be taken the greatest care of."

tendent the simple name of *Peter Michaelof*,* he took his place among the other workmen, and became in all respects one of them, even wearing the same dress, eating the same sort of food, and inhabiting equally humble lodgings. The hut in which he lived is still shown at Saardam. When he first made his appearance in the dockyard nobody knew who he was, and he of course attracted no notice; but, even after his true quality was discovered, he would suffer none of the observances usual to persons of his rank to be paid to him, repelling every attempt of the kind with evident displeasure. And in this way of life he passed several months, during which time he bore a considerable part in the building of a vessel, which, when completed, was named the *St. Peter*, and was purchased by the royal person whose hands had thus helped to put its timbers together. But, while thus employed, the Czar did not neglect his duties and appropriate occupations as a sovereign. After the labours of the day were over, his evenings were generally employed either in writing despatches to the ministers whom he had left in charge of affairs at home; or in holding consultations with his ambassador regarding the negociation pending with the Dutch government, in which he took the most anxious interest, as having for its object the procuring of a supply of vessels and seamen from that power to aid his favourite scheme of forming a navy for Russia. In this application, however, he was unsuccessful.

* That is, Peter the grandson of Michael, according to the manner of forming the surname in Russia among the lower orders. His majesty's proper designation was Peter Alexovitch, or the son of Alexis. *Of*, or *ow*, as it is pronounced, and often written, seems to be the same with the Celtic *O*, still used as a prefix to proper names in Ireland, and the Scottish *oe* or *oy*, which generally signifies a grandchild, but in some districts a nephew, having been applied originally, in all probability, to any near descendant, direct or collateral. *Vitch*, again, is the Norman, or old French, *Fitz*, now *Fils*, a son.

On leaving Holland, Peter proceeded to England in a vessel sent to convey him by the government. But on his arrival in London he insisted upon still being treated only as a private individual. Here he spent his time at first as he had done in Holland, examining the many interesting objects that everywhere met his view. Among other places he went to see the Tower, where he was much delighted with the armoury, and the coining of money in the Mint. He was taken also to see the two Houses of Parliament when sitting; and he appeared twice or thrice at the play, but did not seem to have much relish for that species of amusement. He was very fond, however, of visiting the churches; and was so anxious to learn the mode of worship observed by the different denominations of dissenters, that he attended several of their chapels. On one occasion he was present at a Quakers' meeting. He paid one visit to Oxford, to see the University; and another to Portsmouth, where he was greatly entertained by a mock sea-fight that was exhibited to him. On this occasion he declared that he considered an English admiral a happier man than a Czar of Muscovy.* He also applied himself with zeal and diligence to learn whatever he deemed useful, without regarding the humble nature of any of the handicrafts in which he wished to become a proficient. With these views he did not scruple to work as a common labourer in paper-mills, saw-mills, rope-yards, and other establishments of a similar kind. Voltaire mentions (*Histoire de Russie*, i. 159), that he studied with particular attention the art of watchmaking. His first residence was a house appointed for his reception by government below York Buildings, in the neighbourhood of Westminster Bridge; but he found this both a very noisy place of abode and not conveniently situated for the object on account of which

* Mottley's Life of Peter the Great.

principally he had come to England,—his improvement in the art of ship-building. After a short time, therefore, he removed to Deptford; and here he spent several months in the dockyard, employing himself in the same manner as he had done in that of Saardam. He was so much pleased, it is said, with the superior method of working which he found pursued here, that he used to declare he never should have known his trade had he not come to England. While at Deptford he lodged in the house of the celebrated John Evelyn, author of the 'Sylva,' which stood on the site now occupied by the Workhouse of the parish of St. Nicholas. The circumstance is noticed in Evelyn's Diary under the date of 30th January, 1698: "The Czar of Muscovy being come to England, and having a mind to see the building of ships, hired my house at Say's Court, and made it his court and palace, new furnished for him by the king." He remained here till the 21st of April. Some notion of his manner of living may be obtained from a letter written during this time to Evelyn by his servant: "There is a house full of people, and right nasty. The Czar lies next your library, and dines in the parlour next your study. He dines at 10 o'clock and 6 at night, is very seldom at home a whole day, very often in the king's yard or by water, dressed in several dresses. The king is expected there this day; the best parlour is pretty clean for him to be entertained in. The king pays for all he has."*

While the dockyard, however, was the place in which the Czar spent the greater part of the day, he employed many of his leisure hours in taking lessons in mathematics, navigation, and even anatomy, which he had begun to study while in Holland under the instruction of the eminent professor Frederick Ruysch, whose museum he afterwards purchased for the sum of thirty thousand

* Bray's Memoirs of Evelyn, ii. 60.

florins. Peter, indeed, neglected no opportunity during his travels, of forming the acquaintance of distinguished individuals; and both in Holland and England many of the ablest men of the time were introduced to him, some of whom he persuaded to accompany him home to Russia. He also expended considerable sums in purchasing such curious productions of art as he conceived might best excite the emulation of his subjects.

Among other persons who were made known to him when in England was Bishop Burnet, who does not seem, however, to have quite comprehended the character of the extraordinary man with whom he was on this occasion brought into contact. In the History of his Own Time he tells us the impression the Czar made upon him. "He wants not capacity," he says, "and has a larger measure of knowledge than might be expected from his education, which was very indifferent;" but immediately after he adds that he "seems designed by nature rather to be a ship-carpenter than a prince." He did not at that time appear to the bishop to be capable of conducting so great a design as the attack upon the Turkish empire, which he was understood to be meditating; although it is acknowledged that he afterwards displayed a greater genius for warlike operations than the writer then imagined him to possess. Burnet had a good deal of conversation with him upon religious matters, and remarks that "he was desirous to understand our doctrine, but he did not seem disposed to mend matters in Muscovy." He allows, however, that he was "resolved to encourage learning, and to polish his people by sending some of them to travel in other countries, and to draw strangers to come and live among them." The learned prelate concludes his account by the following curious reflection: "After I had seen him often, and had conversed much with him, I could not but adore the depth of the providence of God that had raised up such a furious

man to so absolute an authority over so great a part of the world."

We cannot enter into any detail of the various reforms in the customs of his people, which this extraordinary man proceeded to introduce on his return to his own dominions, with the view of assimilating them more to those which he had found prevailing in the other countries of Europe. Suffice it to say, that, by a series of the most energetic and frequently violent measures, he succeeded in effecting a complete change in some of the oldest institutions of his empire, and even commenced a revolution in the habits and manners of general society, which, from that beginning, has since gone on till it has established, in what was before almost a barbarous country, all the benefits of a flourishing civilization. Peter may be said, indeed, to have given to his subjects nearly every art of civilized life of which they are now in possession. He taught them navigation, commerce, and even agriculture and the management of flocks, having imported from Saxony and Silesia both herds of sheep and shepherds to take care of them. He called to him artists of all descriptions from other countries, and employed them in contriving, each in his appropriate department, how best to bring into development the natural resources of the country. He built a new capital, the first truly European city that had been seen in Russia, on a site which did not form part of the empire at his accession. Finally, he founded schools, academies, colleges, libraries, and museums, and thus laid the surest of all foundations for the permanent and progressive improvement of his people.

A college of physicians, a dispensary, an observatory, and a botanical garden, were among the establishments with which he adorned his two capitals.* The art of printing had been introduced into Russia about the

* Eloge de Pierre le Grand, par Fontenelle.

middle of the sixteenth century; but this early press seems to have hardly left any trace of its operations, and Peter, at his accession, found his country without books. To supply this deficiency, he had some scientific works translated into Russian; and, when he was in Amsterdam, he employed a printer of that city to print them, giving him a monopoly for the sale of them in Russia. His majesty himself, some time after this, remodelled the alphabet of his native language, considerably simplifying the forms of the characters, and established several printing-houses in Petersburg, at which various elementary works were thrown off, mostly translated from foreign tongues. From this beginning the literature of Russia has so much increased, that in M. Sopikof's *Essai de Bibliographie Russe*, no fewer than thirteen thousand two hundred and forty-nine works are enumerated as having appeared in the native language up to the year 1813. In the three years from 1822 to 1824 inclusive, there appeared two hundred and seventy-five translations from French, German, English, Greek, Latin, Italian, Slavonic, Dutch, Danish, and Armenian, and five hundred and fifty-eight original works; in all eight hundred and thirty-three publications, besides works in foreign languages.*

In 1717, the Czar set out on a second foreign tour, attended on this occasion as became his rank. In the course of his progress he visited successively Hamburg, Berlin, Amsterdam, and Paris; in the last of which cities especially he found all that the arts had yet contrived for the use and enjoyment of man in the highest state of advancement. He no longer now applied his hand to the practice of the different crafts which he inspected; his days of apprenticeship were over; but he was not on that account less diligent in visiting

* These particulars are extracted from the *Aperçu sur la Littérature Russe*, at the end of M. Balbi's *Introduction à l'Atlas Ethnographique*.

every workshop and manufactory in which anything novel or curious was to be seen. He went also to see the observatory, the libraries, and the different learned institutions; and was present at a sitting of the Academy of Sciences, which admitted him one of its members.

This great man's education in his youth had been worse than neglected. His sister and her counsellors had even surrounded him with every seduction most calculated to deprave both his moral and intellectual nature, and to stifle in him the desire of knowledge. The bad parts of his character were undoubtedly, in a great measure, the result of the manner in which he was treated at this time of his life. Yet, violent and ungovernable as his passions continued to be, in some respects, to the last, making him act often with a ferocity unsurpassed by anything that is told of the excesses of infuriated savages, he succeeded in completely overcoming that one of his evil habits which he found would have interfered most with the conduct of his great schemes. In his youth he was a slave to the love of ardent spirits; but he had weaned himself entirely, in his maturer days, from that destructive vice. Nor was he insensible to the other defects of his original character which he had failed to correct. "Alas!" he would sometimes exclaim, on recovering from one of those paroxysms of rage by which he was liable to be carried away, "I have reformed my people, but have not been able to reform myself." Perhaps, however, no man in any station ever did more than this illustrious monarch to repair the mischievous consequences of a neglected youth, as far as intellectual acquirements are concerned. In addition to a competent knowledge of mathematics, mechanics, navigation, medicine, and anatomy, he appears to have made himself master of more than one of the modern languages of Europe. He translated several works from the French, the manuscripts of which are still preserved at Petersburg. He

had even made himself familiar with the Latin tongue, if we are to believe one anecdote told by M. Stählin,* of his detection, upon one occasion, of the inaccuracies of a monk whom he had employed to translate a work written in that language into Russian. But as the original of the work in question (Puffendorff's Introduction to the History of Europe) is in fact not in Latin, but in German, it is probable that it was by his acquaintance with the latter tongue, or with the French, into which the book had also been translated, that Peter was enabled to discover the defects of the Russian version. M. Stählin tells another anecdote, which shows how fully his majesty understood the value of that early instruction which he had not himself enjoyed. Finding two of his daughters one day reading a French author, he desired one of them to translate the passage before her into Russian,—when, struck with the facility with which the task was performed, he exclaimed, "Ah, my children, how happy are you, who are thus taught to read in your youth, and enjoy all the advantages of an education which I totally wanted!" He used often to say that he would willingly have lost one of his fingers to have had a good education in his youth.

When he began at last to educate himself, he did not neglect even the more elegant and ornamental acquirements. During his first visit to Holland, he had an opportunity of seeing many good pictures; and this gave him a taste for painting, to which he was ever afterwards much devoted. Even while at Amsterdam. many of his hours were spent in the working-rooms of the eminent artists who then resided in that city, some of whom he engaged to accompany him to Russia. He afterwards expended very considerable sums in the purchase both of pictures and sculptures; and commenced the formation of a gallery of these works of art at Petersburg.

* Original Anecdotes of Peter the Great: London, 1788.

He also formed a valuable collection of medals. Every department of liberal knowledge, indeed, found in Peter a munificent patron, and, so far as his leisure and opportunities permitted, even an ardent cultivator. When passing through any country interesting from its historical recollections, were he even conducting his army on a warlike expedition, he would go many miles out of his way to examine a celebrated ruin, or to tread a spot that fame had consecrated. In the same spirit, he was especially solicitous for the preservation of the old historic memorials of his own country. While travelling, his constant habit was to obtain as much information as he could beforehand with regard to every place he was about to visit; and, even when he approached the smallest village, he would inquire if it contained anything remarkable. If those about him told him it did not, he would reply "Who knows? If it be not so to you, perhaps it is to me; let me see all." When setting out on his investigations, on such occasions, he carried his tablets in his hand; and whatever he deemed worthy of remembrance was carefully noted down. He would often even leave his carriage, if he saw the country people at work by the wayside as he passed along, and not only enter into conversation with them on agricultural affairs, but accompany them to their houses, examine their furniture, and take drawings of their implements of husbandry.* He obtained in this manner much minute and correct knowledge, which he could scarcely have acquired by any other means, and which he afterwards turned to admirable profit in the improvement of his own country.

M. Stählin, whose notices are in general well authenticated, and may be depended on except where it is likely that his authority was deceived, relates some curious anecdotes in illustration of the Czar's predilec-

* Stahlin's Anecdotes.

tion for operations in surgery, which show at least that he had made no inconsiderable proficiency in the art. He was rarely absent when a dissection took place in Petersburg; and occasionally he assisted as one of the operators. He let blood and extracted teeth with great expertness; and he is recorded to have once tapped a patient for dropsy. These may not seem the most appropriate accomplishments for a king; but we must remember the peculiar circumstances of Russia during the reign of this great author of her civilization. On the one hand, the simplicity of the national manners was such that it was not held at all indecorous for the emperor to mix in the domestic circles of his subjects, almost as one of themselves; and, on the other, the prejudices of the people were so strong, and their aversion to innovation so bigoted, that probably nothing less than the actual example of their sovereign would have roused them to take any interest in the new arts he wished to introduce among them. Peter, therefore, rightly felt that the consideration of the undignified nature of some of the occupations in which he engaged was far more than overbalanced by the advantages that his personal exertions gave him in overcoming the inertness and positive opposition, on the part of his countrymen, which his reforms had to encounter.

This must be his apology also (if the case shall be thought to require any) for certain other labours to which he was sometimes wont to apply his hand. He once passed a month, M. Stählin tells us, at Müller's ironworks at Istia, about seventy miles from Moscow, during which time he employed himself in learning the business of a blacksmith; and so much progress did he make, that on one of the last days of his stay he forged, with his own hand, 720 pounds of iron, making his mark on each bar. On his return to Moscow he proceeded to Müller's house, and, having received from that gentleman the same pay for his labour which would

have been allowed to any other workman, about two shillings of our money, he immediately went and purchased a pair of shoes with it, which he ever afterwards took great pleasure in showing. One of the bars he forged on this occasion is still to be seen at Istia. He was also accustomed, according to Voltaire,* to take his place sometimes among the men employed in cutting canals, a species of public labour on which he expended large sums, in order to encourage and animate them in the more difficult part of their work. But his favourite art was that of ship-building, his lessons in which, learned in Holland and England, he took care not to forget on his return home. The writer of the manuscript narrative in the British Museum, to which we have referred in a note on a former page, gives us some curious information in relation to this matter. The Czar, he tells us, as soon as he got back from England, went down to Veronez, whither he carried two English builders, named Dean and Noy, whom he had brought out with him. Of these, however, "the first," the narrative continues, "soon after desired a discharge, which was granted, without giving any proof of his art. The Czar himself and Joseph Noy received orders from the Lord High Admiral, Theodore Alexowitz Golovin, to build each of them a man-of-war. The Czar, having taken upon himself the title of a master ship-builder, was pleased to subject himself to the condition of that character; and, in compliance with that order, gave the first proof of his skill in the art which he had learned abroad; and continued afterwards to bear that title, and had, at all times, notwithstanding his great engagements in many other affairs, one ship upon the stocks; and at his death left one ship half built, one of the largest in Europe, 180 feet long upon the deck, 51 broad, and 21 deep, and mounts 110 guns, and is by

* Histoire de Russie, ii. 186.

relation one of the finest bodies that has ever been seen; as were, indeed, all the rest he built. He himself drew the draught of this great ship at Riga, where was no master ship-builder but himself; and, when he returned to Petersburg, he gave the surveyor an account that he had drawn his draught of the great ship which he had orders to build from the surveyor's office, and, according to the regulations of the navy, presented his draught to be examined."

The emperor, this writer adds, collected the results of his experience and reading upon the subject of ship-building, and formed them into a regular treatise on the art. This work, however, has not been published, although it is probably preserved, with the other literary productions of the writer, in the Imperial Library at Petersburg. The only work from the hand of Peter the Great which has been printed is his Journal from 1698 to the Peace of Neustadt in 1721. Of this document, which is almost entirely occupied with military transactions, a French translation by M. Formey was published at Berlin in 1773, in one volume quarto.

Peter died in 1725, in the fifty-third year of his age. His history presents us with, perhaps, as remarkable a case of the conquest of difficulties in the pursuit of knowledge as it would be possible to quote. In his noble resolution to educate not only himself but his country, he had to contend with obstacles at every step, which nothing could have overcome but that determination to succeed which overcomes all things. Few monarchs have better deserved the epithet of Great, if he is to be appreciated either by the great powers of mind he displayed, or the great effects he accomplished. And of these last it is to be remarked that none have passed away; all have been permanent and productive. Compare Peter the Great, in this respect, with many other characters who during their time have filled the earth with the noise of their exploits; and how high must he

be placed above them! Alexander's mighty empire fell to pieces as soon as his own hand had resigned its sceptre; so did that of Charlemagne; so did that of Buonaparte. These all, after moving everything, established almost nothing. But whatever the Russian planted still grows and flourishes, and bears fruit more plentifully every year. The reason is, that, while other builders up of empires have trusted, for the support of their institutions, alone or chiefly, to the sword, he based his on the moral strength of knowledge and civilization.

CHAPTER IV.

ADVANTAGES OF WEALTH IN THE PURSUIT OF KNOWLEDGE:—NAPIER.

NOTWITHSTANDING the honourable reputation which the princes we have named, and others whom we have not room to notice, have acquired by their devotion to intellectual pursuits, it must be admitted that science and literature have been much more indebted to the example and patronage, than to the actual performances, of the royal personages who are to be counted among their friends. No great discovery or immortal composition claims a king as its author. When the genius that might have accomplished such has been found on a throne, it has been otherwise occupied than with the quiet but divine pleasures of learning and philosophy. And doubtless this is only as it should be. Men have not crowns put upon their heads that they may write books or spend their lives in constructing philosophical theories. Every station has its peculiar duties, which must first be attended to, even before the pursuit of knowledge; and those of sovereigns are sufficiently arduous to make it impossible, when they are fully performed, that this pursuit can be anything more than the avocation of their leisure. To this extent only, therefore, it is desirable that they should devote themselves to it. But, if so, it cannot be expected that this class of persons should contribute many, or even any, names of first-rate distinction to the history of literature or science. It were not fitting, indeed, that the same individual should have supremacy at once in two worlds so entirely different and unconnected as that of political dignity and that of genius. All, therefore, we repeat, that philosophy and the arts usually have to ask of

kings is, their protection and countenance, and an example which may at least evidence an attachment to intellectual pursuits, even while duties of another sort demand the chief attention. Whether letters, generally speaking, flourish best with or without the patronage of courts, we do not here stop to inquire. It is at all events certain, that in some cases the literary progress of a country has been greatly indebted to a love of literature in its sovereign. Thus it was that Alfred imported civilization into England, James I. into Scotland, and Peter the Great into Russia.

But other individuals in possession of wealth or rank are differently situated from kings. They have often no public duties to perform, or none from which they may not disengage themselves, in so far at least as they would interfere with the closest application to intellectual pursuits. In most countries, indeed, they are not called upon to take a part in the management of affairs, in ordinary circumstances, by any need that the state has of their services so much as by their own ambition for political distinction; and so numerous are almost always the competitors here, that an individual who chooses to withdraw from the throng will rarely have cause to reproach himself with having deserted a post which there are not a hundred others ready, and as well qualified, to occupy. We would neither condemn nor depreciate any path of honourable enterprise; doubtless it is the duty of every man, who believes that he can most benefit his country by his political services, to endeavour to do so. But this is at least an ambition by which many are apt to be seduced, who look rather to its glittering prizes than to their own qualifications; and it is also undeniably one in which something else than merit often contributes to success. There can be no danger, therefore, of too many persons deserting politics for philosophy. There will always be a sufficient number of our men of wealth and rank to serve the state, and contend for her

honours and her offices, although as many leave the crowd as the love of study and speculation can possibly withdraw.

But political ambition, in truth, is not the seduction by which persons of this description are most apt to be enthralled. The besetting temptations attendant upon the possession of wealth and leisure (which, rightly employed, constitute such inestimable advantages) are the facilities which they afford to the indulgence of mere indolence and love of pleasure. A rich man, who can live without exertion of any kind, is apt to lose the power even of that degree of exertion which is necessary for the acquisition of knowledge. Besides, his money provides him with other enjoyments; and he often never even acquires a taste for those of an intellectual kind. A defective or misdirected education too frequently only prepares him the better for yielding to the unfortunate influences of his position; and the habits and prejudices of society come also to assist their force and confirm their dominion. When an individual thus circumstanced, therefore, betakes himself in good earnest to the pursuit of knowledge, he also is entitled to be regarded as one who has exhibited much energy of character, and conquered many difficulties, as well as he who has had to struggle with poverty, or an uncongenial occupation, in his attempts to obtain an acquaintance with books. The impediments which have lain in the way of the former are different from those that have beset the path of the latter; but they may not have been less difficult to overcome. The fact, at all events, is, that the temptations of wealth have often exerted as fatal an influence in repressing all ardour for intellectual pursuits as ever did the obstructions of indigence.

Yet, where the love of knowledge has taken full possession of the heart, the rich man is much more favourably situated than the poor man for the prosecution of great enterprises in science or literature, demanding as

they do both leisure and ease of mind—two good things, of the first of which generally but little, and of the second often not much, are his who has to provide for his daily bread by his daily labour. Hence some of the greatest names, in all departments of philosophy and learning, are those of persons who, unembarrassed by the toils and cares of obtaining a subsistence, have been free to lead a life of contemplation, having purchased to themselves that inestimable privilege by a relinquishment of the other pleasures or objects of ambition ordinarily pursued by those in their situation, and seeking no other advantage from their riches or their competence than that of being at liberty to devote their time and their powers of mind to labours of their own choosing. From the list of the illustrious of ancient times, we need mention no others, and we can mention no greater, than Plato and Archimedes—both of whom were of distinguished birth (the former being a descendant of the family of Solon, the other a near relation of King Hiero), and, there is every reason to suppose, opulent. But we pass from times so remote, that, even when the circumstances of the case are well ascertained, the changes that have taken place in everything detract from the value of an example or illustration, in order to notice two or three of the more remarkable instances which belong to a state of society more nearly resembling our own.

The first name we shall mention is that of JOHN NAPIER—commonly called Lord Napier. He was not, however, a nobleman, but only what would in England be called a lord of a manor. Such persons in Scotland were formerly designated *barones minores*, or *lesser barons*; and to this class the Baron of Bradwardine belonged as well as Napier, who in like manner was Baron of Marchistown, or Merchiston,* an old seat of the family in

* Thus, on the title-page of his 'Mirifici Logarithmorum Canonis Descriptio,' (Edin. 1614,) he calls himself 'Baro Merchistonii.' He

the neighbourhood of Edinburgh. Here, or, according to other authorities, at Gartness in Stirlingshire (an estate which also belonged to the family), Napier was born, in the year 1550, at which time his father, who lived for fifty-eight years after this, could not have been older than sixteen. In 1562 he entered St. Salvator's college, St. Andrews, as appears by the books of the university.* At this time, of course, he was only twelve years old; but this was not an unusually early age in those days for going to college in Scotland. Many entered even younger; and in the university of Glasgow it was found necessary to make a law that no student should be admitted to the degree of bachelor of arts before the age of fifteen, unless upon good reason appearing to dispense with a year in any particular case. Napier's own language, therefore, is not inappropriate, when, in his treatise on the Apocalypse, published in 1593, he tells us that it is "no few years" since he began to "precogitate the same," being then, as he adds, in his "tender years and barneage (childhood) at St. Andrees, at the schools."

On leaving college, Napier is understood to have set out on his travels, in the course of which he visited France, Italy, and Germany. It is not known when he returned home; but he was probably a considerable time abroad, since we hear little more of him till he was above forty years of age. On arriving again in his own country, although he had already acquired considerable

was not, on this account, however, either "the Lord Marchiston," as he is described by Lilly the astrologer, or "the Lord Napier," as he has been called by others. He was merely *laird* of Merchiston; a title which, although of course etymologically identical with the English *lord*, is applied in Scotland to any landed proprietor.

* Lord Buchan, in his Life of Napier (Edinb. 1788), conjectures that he did not go to college till 1566: and observes that the records of the university do not ascend higher than the beginning of the seventeenth century. They reach, in fact, to the year 1413, when the university was opened.

reputation for abilities and learning, and might probably have entered upon a political career with many advantages, he declined engaging in public affairs, and retired to Merchiston, with the intention of devoting himself exclusively to study. A room in which he used to seclude himself for this purpose, at the top of the old tower of Merchiston, is still shown; and he is also said to have resided occasionally at Gartness, where he was looked upon by the common people, we are told, as a wizard—a common fate of learned and studious men, down even to an age so recent as this, although Napier's is probably one of the latest names that acquired this species of celebrity. As an evidence that his renown for more than mortal knowledge was not confined to the simple peasantry of Stirlingshire, we may mention that there is preserved in the British Museum a small tract, printed in London, of which the following is the title: 'A Bloody Almanack, fortelling many certaine predictions which shall come to pass this present yeare 1647; with a calculation concerning the time of the day of judgment, drawne out and published by that famous astrologer, the Lord Napier of Merchiston.'

But the fact is, that, although Napier did not himself profess to be either necromancer or astrologer, he cannot be altogether acquitted of pretending to this very insight into futurity which is here attributed to him. The first publication which he gave to the world was an exposition of the Revelations, which appeared at Edinburgh in 1593, prefaced by a dedication to James VI., which is characterised by singular plainness of speech. "Verily and in truth," says the writer, "such is the injury of this our present time, against both the church of God and your majesty's true lieges, that religion is despised and justice utterly neglected; for, what by atheists, papists, and cold professors, the religion of God is mocked in all estates; again, for partiality, prolixity, dearth, and deceitfulness of laws, the poor

perish, the proud triumph, and justice is nowhere to be found." He then beseeches his majesty to attend himself to these enormities, assuring him that, if he act justly to his subjects, "God will ministrate justice to him against all his enemies; and contrarily, if otherwise." In redressing the evils denounced, he goes on to exhort him to "begin at his own house, family, and court;" a step, the necessity of which he endeavours to impress upon him at considerable length, and with extraordinary intrepidity. There is not a word of flattery in the whole epistle. As for the work itself, it is of a similar character to many others that have been written upon the same mysterious subjects. The most important proposition which it professes to demonstrate is, that the end of the world is to take place some time between the years 1688 and 1700. It is a large and elaborate treatise, and is garnished occasionally with effusions in rhyme, sometimes original, and sometimes translated. Among other aids, the author presses the famous Sibylline Oracles into his service, ornamenting them with a metrical version and a commentary. This work appears to have attracted a great deal of attention on its first appearance, and to have retained its popularity for a considerable time. It did not, perhaps, cease to be generally remembered till the termination of the seventeenth century effectually refuted its conclusions. A fifth edition of it, we observe, appeared at Edinburgh in 1645, which was, perhaps, not the last. It was translated into the French language, and published at Rochelle in 1602.*

* Napier's book probably occasioned some controversy There is a MS. in the British Museum, entitled 'Porta Lucis, or the way to decypher the name, number, and mark of the Beast, by a method more rational, free, and unstrained than ever any hitherto; occasioned by the peremptoro determination of the Lord Napier of Merchistoune, upon the name Λατεινος.' The only part of the promised treatise, however, which the MS. contains is the Preface, in twelve and a half closely written folio pages.

Napier's mathematical studies, after all, however, probably did more to procure for him the reputation of being a magician than even these theological lucubrations. It was believed, it seems, that he was attended by a familiar spirit in the shape of a black cock. A curious anecdote, for the truth of which undoubted evidence exists, would even lead us to suppose that he was not himself averse to being thought in possession of certain powers or arts not shared by ordinary men. A document is still preserved, containing a contract which he entered into in July, 1594, with a brother baron, Logan of Restalrig, to the effect that, "forasmuch as there were old reports and appearances that a sum of money was hid within Logan's house of Fastcastle, John Napier should do his utmost diligence to search and seek out, and by all craft and ingine to find out the same, and by the grace of God shall either find out the same, or make it sure that no such thing has been there. For his reward he was to have the exact third of all that was found, and to be safely guarded by Logan back to Edinburgh with the same: and in case he should find nothing, after all trial and diligence taken, he refers the satisfaction of his travel and pains to the discretion of Logan."* This, it will be observed, is very cautiously expressed, and so as not distinctly to advance on Napier's part any claim to supernatural skill; but a person engaging in such negociations could hardly be very much surprised, in that age, if he was held to be acquainted with more of the sciences than he chose to admit. The whole affair places before us a very curious picture of the times.

We do not know exactly when it was that Napier deserted theology for mathematics—having in this respect taken the opposite course to that followed long afterwards by the celebrated Count Swedenborg, who, having

* Douglas's Peerage, by Wood, ii. 291. This is the same Logan of Restalrig who figures in the famous Gowrie Conspiracy.

been all his previous life a mere man of science, began, when between fifty and sixty years of age, to see visions of the spiritual world, and to converse with angels. But the work upon the Apocalypse was, at any rate, the last of his theological publications. He is understood to have devoted his attention in subsequent years chiefly to astronomy, a science which, recently regenerated by Copernicus and Tycho Brahe, was then every day receiving new illustrations from the discoveries of Kepler and Galileo. The demonstrations, problems, and calculations of this science most commonly involve some one or more of the cases of trigonometry, or that branch of the mathematics which, from certain parts, whether sides or angles, of a triangle being given, teaches how to find the others which are unknown. On this account trigonometry, both plane and spherical, engaged much of Napier's thoughts; and he spent a great deal of his time in endeavouring to contrive some method by which the operations in both might be facilitated. These operations, the reader who may be ignorant of mathematics will observe, always proceed by ratios, or proportions. Thus, if certain lines be described in or about a triangle, one of these lines will bear the same proportion to another as a certain side of the triangle does to a certain other side. That is to say, there are two ratios, each consisting of two terms. Now, of the four particulars three may be known, and then the fourth will be found by multiplying together the known term of the second ratio with one of the two terms of the first, and dividing the product by the other. This rule is derived from the very nature of proportion, but it is not necessary that we should stop to demonstrate it. It will be perceived, however, that it must give occasion, in solving the problems of trigonometry, to a great deal of multiplying and dividing,—operations which, as everybody knows, become very tedious whenever the numbers concerned are large; and they

are generally so in astronomical calculations. Hence such calculations used to exact immense time and labour, and it became most important to discover, if possible, a way of shortening them. Napier, as we have said, applied himself assiduously to this object; and he was, probably, not the only person of that age whose attention it occupied. He was, however, undoubtedly, the first who succeeded in it—which he did most completely by the admirable contrivance which we are now about to explain.

When we state that 2 bears a certain relation to 6, we may mean either that 2 is the third part of 6, or that 2 is less than 6 by 4. If the former be what we mean, we may say that the relation in question is the same as that of 3 to 9, or of 4 to 12; if the latter, we may say that it is the same as that of 3 to 7, or of 4 to 8. The former kind of relation is often called *geometrical*, the latter *arithmetical*, proportion; the former being that which regards the number of times, or parts of times, the one quantity is contained in the other; the latter regarding only the difference between the two quantities. It is better, however, to confine our use of the word proportion, as we have done in the last paragraph, to geometrical, which is the only true proportion. Now, while, as we have stated, it is the property of four numbers, the first and second of which have the same *geometrical* relation as the third and fourth, that the *product* of the second and third, divided by the first, gives the fourth, where the relation is *arithmetical* the *sum* of the second and third, diminished by the *subtraction* of the first, gives the fourth. Thus in the series 2, 4, 3, 6, in which the identity of the relations between the 2 and the 4 and between the 3 and the 6 is geometrical (the one quantity being the double of the other), if 4 be multiplied by 3 it gives 12, which, divided by 2, gives 6; but in the series 2, 4, 3, 5, where the identity of the relations between the 2 and the 4 and between

the 3 and the 5 is arithmetical (consisting in a difference of the same quantity 2), 4 and 3 being added together make 7, from which if 2 be subtracted there remains the fourth term 5. It is plain, therefore, that, especially where large numbers are concerned, operations in what has been called arithmetical must be much more easily performed than operations in true or geometrical proportion; for in the one case you have only to add and subtract, while in the other you have to go through the greatly more laborious processes of multiplication and division.

Now it occurred to Napier, reflecting upon this important distinction, that a method of abbreviating the calculation of a *geometrical* proportion might perhaps be found, by substituting, upon certain fixed principles, for its known terms, others arithmetically (or differentially) related, and then finding, in the quantity which should result from the addition and subtraction of these last, an indication of that which would have resulted from the multiplication and division of the original figures. It had been remarked before this, by more than one writer,* that if the series of numbers, 1, 2, 4, 8, &c., that proceed in geometrical progression, that is, by a continuation of geometrical ratios, were placed under, or alongside of, the series, 0, 1, 2, 3, &c., which are in arithmetical progression, the addition of any two terms of the latter series would give a sum, which would stand opposite to a number in the former series indicating the product of the two terms in that series which corresponded in place to the two in the arithmetical series first taken. Thus, in the two lines,

1,	2,	4,	8,	16,	32,	64,	128,	256,
0,	1,	2,	3,	4,	5,	6,	7,	8,

* Namely, by H. Grammateus, in his 'Commercial Arithmetic, published in German, at Vienna, in 1518; and more clearly by Michael Stifel, in his *Arithmetica Integra*, printed at Nuremberg in 1544. See Montucla, *Histoire des Mathématiques*, ii. 19. Even Archimedes was acquainted with these relations.

the first of which consists of numbers in geometrical, and the second of numbers in arithmetical progression, if any two terms, such as 2 and 4, be taken from the latter, their sum 6, in the same line, will stand opposite to 64 in the other, which is the product of 4 multiplied by 16, the two terms of the geometrical series which stand opposite to the 2 and 4 of the arithmetical. It is also true, and follows directly from this, that if any three terms, as, for instance, 2, 4, 6, be taken in the arithmetical series, the sum of the second and third, diminished by the subtraction of the first, which makes 8, will stand opposite to a number (256) in the geometrical series which is equal to the product of 16 and 64 (the opposites of 4 and 6), divided by 4 (the opposite of 2).

Here, then, is, to a certain extent, exactly such an arrangement, or table, as Napier wanted. Having any geometrical proportion to calculate, the known terms of which were to be found in the first line or its continuation, he could substitute for them at once, by reference to such a table, the terms of an arithmetical series which, wrought in the usual simple manner, would give him a result that would point out or indicate the unknown term of the geometrical series. But unfortunately there were many numbers which did not occur in the upper line at all, as it here appears. Thus, there were not to be found in it either 3, or 5, or 6, or 7, or 9, or 10, or any other numbers, indeed, except the few that happen to result from the multiplication of any of its terms by 2. Between 128 and 256, for example, there were 127 numbers wanting, and between 256 and the next term (512) there would be 255 not to be found.

We cannot here attempt to explain the methods by which Napier's ingenuity succeeded in filling up these chasms, but must refer the reader, for full information upon this subject, to the professedly scientific works

which treat of the history and construction of logarithms.* Suffice it to say, that he devised a mode by which he could calculate the proper number to be placed in the table over against any number whatever, whether integral or fractional. The new numerical expressions thus found, he called *Logarithms*, a term of Greek etymology, which signifies the ratios of numbers. The table, however, which he published, in the first instance, in his *Mirifici Logarithmorum Canonis Descriptio*, which appeared at Edinburgh in 1614, contained only the logarithms of the sines of angles for every degree and minute in the quadrant, which shows that he chiefly contemplated, by his invention, facilitating the calculations of trigonometry. These logarithms differed also from those that are now in use, in consequence of Napier having chosen originally, a different geometrical series from that which has since been adopted. He afterwards fixed upon the progression, 1, 10, 100, 1000, &c., or that which results from continued multiplication by 10, and which is the same according to which the present tables are constructed. This improvement, which possesses many advantages, had suggested itself about the same time to the learned Henry Briggs, then Professor of Geometry in Gresham College,—one of the persons who had the merit of first appreciating the value of Napier's invention, and who certainly did more than any other to spread the knowledge of it, and also to contribute to its perfection. Lilly, the astrologer, gives us, in his Memoirs, a curious account of the intercourse between Briggs and Napier, to which the publication of the logarithmic calculus led. "I will acquaint you," he writes, "with one memorable story related unto me by

* See especially Montucla, *Histoire des Mathématiques*, ii. 16, &c.; Delambre, *Histoire de l'Astronomie Moderne*, i. 491, &c.; and, especially, the Preface to Hutton's Mathematical Tables, London, 1785, which is reprinted in the first volume of Baron Maseres's *Scriptores Logarithmici*.

John Marr, an excellent mathematician and geometrician, whom I conceive you remember. He was servant to King James and Charles the First. At first, when the Lord Napier, or Marchiston, made public his logarithms, Mr. Briggs, then reader of the Astronomy Lectures at Gresham College, in London, was so surprised with admiration of them, that he could have no quietness in himself until he had seen that noble person, the Lord Marchiston, whose only invention they were; he acquaints John Marr herewith, who went into Scotland before Mr. Briggs, purposely to be there when these two so learned persons should meet. Mr. Briggs appoints a certain day when to meet at Edinburgh; but failing thereof, the Lord Napier was doubtful he would not come. It happened one day, as John Marr and the Lord Napier were speaking of Mr. Briggs; 'Ah, John,' said Marchiston, 'Mr. Briggs will not now come.' At the very instant one knocks at the gate; John Marr hasted down, and it proved Mr. Briggs, to his great contentment. He brings Mr. Briggs up into my lord's chamber, where almost one quarter of an hour was spent, each beholding other, almost with admiration, before one word was spoke. At last Mr. Briggs began: 'My lord, I have undertaken this long journey purposely to see your person, and to know by what engine of wit or ingenuity you came first to think of this most excellent help into astronomy, viz. the logarithms; but, my lord, being by you found out, I wonder nobody else found it out before, when now known it is so easy.' He was nobly entertained by the Lord Napier; and every summer after that, during the lord's being alive, this venerable man, Mr. Briggs, went purposely into Scotland to visit him."

Napier's discovery was very soon known over Europe, and was everywhere hailed with admiration by men of science. The great Kepler, in particular, honoured the author with the highest commendation, and dedicated

to him his Ephemerides for 1617. This illustrious astronomer, also, some years afterwards, rendered a most important service to the new calculus, by first demonstrating its principle on purely geometrical considerations. Napier's own demonstration, it is to be observed, though exceedingly ingenious, had failed to satisfy many of the mathematicians of that age, in consequence of its proceeding upon the supposition of the movement of a point along a line—a view analogous, as has been remarked, to that which Newton afterwards adopted in the exposition of his doctrine of fluxions, but one of which no trace is to be found in the methods of the ancient geometers.

Napier did not expound the process by which he constructed his logarithms in his first publication. This appeared only in a second work, published at Edinburgh in 1619, after the death of the author, by his third son, Robert. In this work also the logarithmic tables appeared in the improved form, in which, however, they had previously been published at London, by Mr. Briggs, in 1617. They have since then been printed in numberless editions, in every country of Europe. Nay, in the year 1721, a magnificent edition of them, in their most complete form, issued from the imperial press of Pekin, in China, in three volumes, folio, in the Chinese language and character. As for the invention itself, its usefulness and value have grown with the progress of science; and, in addition to serving still as the grand instrument for the abridgment of calculation in almost every department in which figures are employed, it is now found to be applicable to several important cases which could not be managed at all without its assistance. Some of the greatest names in the history of science, we may also remark, since Napier's time, have occupied themselves with the subject of the theory and construction of logarithms; and the labours of Newton, James Gregory, Halley, and Euler, have especially contributed

to simplify and improve the methods for their investigation.

Napier, however, did not live long to enjoy the reputation of his discovery, having died at Merchiston on the 3rd of April, 1617, in the sixty-eighth year of his age. That same year he had published at Edinburgh a small treatise in Latin, of about one hundred and fifty pages, which he antitled 'Rabdologiæ, seu Numerationis per Virgulas, Libri Duo.' It contained an account of a method of performing the operations of multiplication and division by means of a number of small rods, having the digits inscribed upon them according to such an arrangement as that, when placed alongside of each other in the manner directed, in order, for instance, to multiply any two lines of figures, the several lines of the product presented themselves, and had only to be transcribed and added up to give the proper result. This was not, however, nearly so convenient a contrivance as that of logarithms, even for multiplication, and it was still less useful in division; on which account it has been supposed that, although given to the world so late, it was probably an expedient which had suggested itself to Napier for the abridgment of calculation before his great invention. It has been thought, too, of so little practical utility as, in all likelihood, never to have been actually employed for the purposes of calculation.* A little tract, nevertheless, it may be remarked, appeared at London so late as the year 1684, entitled 'Enneades Arithmeticæ,' containing, among other things, an account of "the Numbering Rods of the Right Honourable John, Lord Neper, enlarged;" and this work bears to be "printed for Joseph Moxon, at the sign of the Atlas in Ludgate street, *where also these numbering rods (commonly called Napier's bones) are made and sold.*" These rods, or bones, we may add, are what

* Montucla, *Histoire des Mathématiques*, ii. 26.

Butler alludes to in his Hudibras, where in the account of the "rummaging of Sidrophel," he speaks of

> "A moon-dial, *with Napier's bones*,
> And several constellation stones,*
> Engraved in planetary hour,
> That over mortals had strange power."†

It was principally, as we have seen, with a view to the simplification of operations in trigonometry that Napier proposed the logarithmic calculus. This was not the only improvement which he contributed to that branch of science. Among others, it owes to him a formula of great elegance and convenience, by which the solution of all the cases of spherical trigonometry is comprehended under a single rule. This, with several other new views in the same department of the mathematics, appeared for the first time in his second work on logarithms, published at Edinburgh, as we have already mentioned, in 1619.

But his ingenious and contriving mind did not confine itself merely to speculative science, if we may believe the very curious statements which he makes with regard to some of his other inventions, in a paper with his signature, which is preserved among the manuscript collections of Anthony Bacon (the brother of the Lord Chancellor Bacon) in the archiepiscopal library at Lambeth. This paper, which has of late years been

* A correspondent informs us that he has seen at Gartness globular stones with the circles of the sphere and constellations engraven on them, and concave stones with engravings of a like character, said to have been made by Napier. They were certainly not of modern date, and one is built into the wall of a mill, where it is still to be seen.

† Part ii. canto 3, v. 1095. See also canto 2, v. 409. It was perhaps these notices in Hudibras that led Sir Walter Scott to make Davie Ramsay in the *Fortunes of Nigel* swear "by the bones of the immortal Napier." The late Professor Napier, of Edinburgh, was in possession of the set of bones said to have been used by the inventor of logarithms, from whom he claimed to be descended.

several times printed,* is entitled 'Secret Inventions, profitable and necessary in these days for the defence of this island, and withstanding of strangers, enemies to God's truth and religion.' Of these, the first is stated to be "a burning mirror for burning ships by the sun's beams," of which the author professes himself able to give to the world the "invention, proof, and perfect demonstration, geometrical and algebraical, with an evident demonstration of their error who affirm this to be made a parabolic section." The second is a mirror for producing the same effect by the beams of a material fire. The third is a piece of artillery contrived so as to send forth its shot, not in a single straight line, but in all directions, in such a manner as to destroy everything in its neighbourhood. Of this the writer asserts that he can give "the invention and visible demonstration." The fourth and last of these formidable machines is described to be "a round chariot in metal," constructed so as both to secure the complete safety of those within it, and, moving about in all directions, to break the enemy's array "by continual charges and shot of the arquebuse through small holes." "These inventions," the paper concludes, "besides devices of sailing under the water, and divers other devices and stratagems for harassing of the enemies, by the grace of God and work of expert craftsmen, I hope to perform. John Napier, of Merchiston, anno dom. 1596, June 2."

From this date it would appear that Napier's head had been occupied with the contrivances here spoken of long before he made himself known by those scientific labours for which he is now chiefly remembered; and, indeed, we might perhaps have inferred, even from the general nature of the inventions, and the object which

* In Dr. Anderson's Bee, vol. iii. p. 133,—in Lord Buchan's Life of Napier,—in Tilloch's Philosophical Magazine, vol. xviii. pp. 53, &c., and elsewhere. There is also a copy of it in the British Museum among the MS. collections of Dr. Birch.

the author avows he had in view by them, that they were the product of that part of his life in which his apprehension of the encroachments of popery contributed to animate his studies. Some of the announcements are certainly very extraordinary, and would almost lead us to suppose that the writer in this paper rather intended to state what he conceived to be possible than what he had himself actually performed. Yet several of his expressions will not bear this interpretation; and there are not wanting other attestations which go to confirm what he asserts as to his having really constructed some of the machines he speaks of. There is a passage in a strange work, entitled 'The Jewel,' written by Sir Thomas Urquhart, and first published in 1652, which seems manifestly to allude to the third invention here enumerated. Sir Thomas, although certainly not the most veracious of authorities, would scarcely, one would think, have ventured to publish what we are now going to quote, only five and thirty years after Napier's death, if there had not been some foundation for his statement. His description may be sufficiently overcharged (for he writes, it will be observed, in an extravagantly bombastic and hyperbolical strain) without being altogether a fiction. After eulogizing Napier's mathematical learning in very high-sounding terms, Sir Thomas proceeds to remark, that he deems him especially entitled to remembrance on account of "an almost incomprehensible device, which, being in the mouths of the most of Scotland, and yet unknown to any that ever was in the world but himself, deserveth very well to be taken notice of in this place;"—"and," he adds, "it is this: he had the skill (as is commonly reported) to frame an engine (for invention not much unlike that of Archytas' dove), which, by virtue of some secret springs, inward resorts, with other implements and materials fit for the purpose, inclosed within the bowels thereof, had the power, if proportionable in bulk to the action required of it (for

he could have made it of all sizes), to clear a field of four miles circumference of all the living creatures exceeding a foot of height that should be found thereon, how near soever they might be to one another; by which means he made it appear that he was able, with the help of this machine alone, to kill 30,000 Turks, without the aid of one Christian. Of this it is said that (upon a wager) he gave proof upon a large plain in Scotland, to the destruction of a great many heads of cattle and flocks of sheep, whereof some were distant from other half a mile on all sides, and some a whole mile."*

It were to have been desired, certainly, that our author had been a little more particular in his description of the scene of this devastating exploit among the cattle—"a large plain in Scotland," being rather an unsatisfactory form of expression, even in reference to a country where there are not a great many large plains; but this indefinite mode of writing is only Sir Thomas's usual style. We are not inclined, indeed, to put much faith in the rumour here recorded that Napier actually put the power of his machine to the proof in the manner described; but the whole statement, taken in conjunction with what we have found the alleged inventor asserting under his own hand, seems to put it beyond doubt that he had at least imagined some such contrivance as that alluded to in the above passage, and even that his having done so was matter of general notoriety in his own day, and for some time after. Sir Thomas Urquhart was born in 1613, some years before Napier's death, and his 'Jewel' was first published in 1652. Napier, he informs us, when requested on his death-bed to reveal the secret of this engine of such extraordinary potency in the destruction of cattle, sheep, and Turks, refused to do so, on the score of there being too many instruments of mischief in the world already for it to be the business of

* 'The Discovery of a most rare Jewel,' &c.; second edit. Edinburgh, 1774, pp. 57, 58.

any good man to add to their number.* This may remind the reader of the story told respecting a machine of somewhat similar pretensions constructed at a later period by the celebrated James Gregory, of which Sir Isaac Newton, when it was shown to him, is said to have expressed his disapprobation on the same ground which Napier is here made to take. But the truth is, as has been often remarked, that the introduction of machines capable of producing the tremendous effects ascribed to those in question would, in all probability, very soon put an end to war,—which has not become more destructive, but the reverse, since the invention of a more formidable artillery than that anciently in use; and which, waged with such contrivances as those of Napier and Gregory, would certainly never be resorted to by nations as a mode of settling their differences, until they had become literally insane. Another consideration, however, which might suggest itself to a man of very scrupulous feelings on such a matter, is, that it would be unfair for him to put even his native country in possession of an instrument which would, in fact, give her an advantage in her disputes with the rest of the world against which there would be no possibility of contending. If it put an end to war, which is one great evil, it would do so by the still greater evil of enabling a single nation to triumph over the prostration of all the rest.

There appeared, a good many years ago, in one of our periodical works,† a very able and learned commentary on Napier's 'Secret Inventions,' the writer of which has collected, with great industry, whatever notices the annals of science afford of achievements similar to those which the Scottish mathematician is asserted to have

* There is a common belief, it seems, amongst the people at Gartness, that this machine is buried in the ground, near the site of the old castle said to have been occupied by Napier.

† Tilloch's Philosophical Magazine, vol. xviii. pp. 53—65, (published Feb. 1804). See also pp. 245, &c.

performed. In regard to the mirror for setting objects on fire at a great distance by the reflected rays of the sun, he adduces the well-known story of the destruction of the fleet of Marcellus, at Syracuse, by the burning-glasses of Archimedes, and the other (not so often noticed) which the historian Zonaras records, of Proclus having consumed by a similar apparatus the ships of the Scythian leader Vitalian, when he besieged Constantinople in the beginning of the sixth century.* The possibility of such feats as these was long disbelieved; but may be considered as having been fully demonstrated by the experiments of modern times. Buffon, in particular, in the year 1747, by means of four hundred plane mirrors, actually melted lead and tin at a distance of fifty yards, and set fire to wood at a still greater. This, too, was in the months of March and April. With summer heat it was calculated that the same effects might have been produced at four hundred yards' distance—or more than ten times that to which, in all probability, Archimedes had to send his reflected rays. It may be concluded, therefore, that there is nothing absolutely incredible in the account Napier gives of his first invention. His second announcement, however, is a good deal more startling; inasmuch as he here professes to have succeeded in an attempt in which nobody else is recorded to have made any approach to success. Gunpowder has been lighted by heat from charcoal collected by one concave mirror and reflected from another; but no such effect has ever been produced by a single reflection of artificial heat. It is not very easy to comprehend the nature of the chariot mentioned by Napier as his fourth invention; but it seems to bear some resemblance, this writer remarks, to one of the

* Malala, another old chronicler, however, says that Proclus operated on this occasion, not by burning-glasses, but by burning sulphur showered upon the ships from machines. *Vide* Montucla, *Histoire des Mathématiques*, i. 334.

famous Marquis of Worcester's contrivances. As for the device for sailing under water, noticed in the last paragraph of the paper, that exploit was performed in Napier's own day by the Dutch chemist Cornelius Drebell, who is reported to have constructed a vessel for king James I., which he rowed under the water on the Thames. It carried twelve rowers, besides several passengers, the air breathed by whom, it is said, was made again respirable by means of a certain liquor, the composition of which Boyle asserts in one of his publications that he knew, having been informed of it by the only person to whom it had been communicated by Drebell. Bishop Wilkins, also, who lived very near the time at which it was performed, expressly mentions Drebell's experiment in his Mathematical Magic. Various successful essays in subaqueous navigation have also been made in more recent times.

It is to be lamented that the only one of Napier's inventions, the secret of which was solicted from him by his friends when he was leaving the world, should have been that which his conscience would not allow him to reveal, for the reason that has been stated. Had they asked him to explain to them his method of sailing under the water, for example, or even the construction of his burning mirrors, he probably would have had no excuse for withholding the information. But they seem to have been so anxious to get possession of the machine for destroying the thirty thousand Turks, that they had not a thought to spare for any of the other contrivances. The circumstance, however, of some of these inventions not having been re-discovered by any one else since Napier's time ought not of itself to be taken as conclusive evidence that his pretensions to a knowledge of them were mere dreams. Extraordinary as is the progress that Science has made within the last two centuries, during which period the conquests she has effected have been more numerous and wonderful than had been wit-

nessed by all the previous centuries that had elapsed from the beginning of the world, there can be no doubt that some of her apparently new inventions have been only the forgotten discoveries of a preceding age revived, and also that there were some things known in former times which modern ingenuity has not yet recovered from oblivion. Such machines as those which Napier professes to have constructed are exactly of the description least likely, for very obvious reasons, to occur to a modern speculator.*

In that curious record, Birrell's Diary, which was printed at Edinburgh about the beginning of the present century, we find, under date of the 23rd October, 1598, the following notice: "Ane proclamation of the Laird of Merkistoun, that he tuik upon hand to make the land mair profitable nor it wes before, be the sawing of salt upon it." There can be little doubt, we think, that this was another scheme of the inventor of logarithms; although the patent for the new mode of manuring appears to have been taken out in the name of his eldest son, Archibald, who had been infeft in the fee of the barony by his father about a year before.† The patent, or gift of office, as it is called, was granted upon condition that the patentee should publish an account of his method in print, which he did accordingly shortly afterwards, under the title of 'The new order of gooding and manuring all sorts of field land with common salt.' The facts that have been mentioned are interesting as esta-

* For a great deal of curious information on the lost and revived inventions of antiquity, the reader may consult G. Pasch's learned work, entitled 'De Novis Inventis quorum accuratiori cultui facem praetulit antiquitas,' of which a second edition appeared at Leipsic in 1700; or Dutens's 'Recherches sur l'origine des découvertes attribuées aux modernes,' first published in 1766, and, for the fourth time, in 1812. Of this last work there is an English translation. See also Theod. Almeloveen's *Inventa Nov-Antiqua.*

† See Records of Privy Council for 22nd June, 1598, quoted in Douglas's Peerage, by Wood, ii. 292.

blishing Napier's claim to an agricultural improvement which has been revived in our own day and considered of great value.* The profits of the invention were probably given up to his son, who was at this time a young man of only twenty-five years of age, from the same disinterested feeling which had led his father previously to enfeoff him in his estate. Devoted to his books, Napier may have been somewhat indifferent about money; and one of his contemporaries† even goes so far as to assert, that he dissipated his fortune by his experiments. Of this, however, there is no evidence; indeed, it appears that, occupied as much of his time was about other matters, he had taken good care of his property, which at his death was of large amount, both in land and in money, goods, and chattels. And, if he suggested this method of manuring with salt, he must be allowed to have directed his speculations occasionally to the improvement of the arts of common life, as well as to that of the abstract sciences.

Napier was twice married, and had twelve children, of whom Archibald, the eldest, mentioned above, was raised to the peerage, by the title of Lord Napier, in 1627. A small volume of Memoirs of this person, written by himself, was published in 1793. There are said to be still in the possession of the family some productions of their distinguished ancestor on scientific subjects, which have not been printed—especially a treatise, in English, on Arithmetic and Algebra, and another, on Algebra, in Latin.‡

* See Parkes on 'The advantages of using Salt.'

† Thomas Dempster, a man of eminent learning and ability, but by no means to be always depended upon in what he states upon his own authority.

‡ Douglas's Peerage, by Wood, ii. 290. Since the first publication of the present work, much new information about the inventor of Logarithms has been given to the world by his descendant, Mark Napier, Esq., in 'Memoirs of John Napier of Merchiston,' 4to., Edin. and London, 1834.

The life which we have thus sketched may be considered as affording us an eminent example of the manner in which the many advantages enjoyed by the wealthy may be turned to account in the pursuit of learning and philosophy. A good education, access to all the best means of improvement, uninterrupted leisure, comparative freedom from the ordinary anxieties of life, the means of engaging in inquiries and experiments the expense of which cannot be afforded by the generality of students—the possession of all these things, to the mind that knows how to profit by them, is indeed invaluable. We have seen what they produced in Napier's case. In dedicating his time and his fortune to pursuits so much nobler than those that have usually occupied persons of his station, this illustrious individual had his ample reward. We can scarcely doubt that he led a happier life in his studious retirement, in the midst of his books and his experiments, than if he had given himself either to the ordinary pleasures of the world, or to the hazards and vexations of political ambition. The more useful and more honourable path he certainly chose. By his great and fortunate discovery he made the science of all succeeding times his debtor, and constituted himself the benefactor of every generation of posterity. And then for fame, which our very nature has made dear to us, that, too, this philosopher found in abundance in his closet of meditation. Even in his own day his renown was spread abroad over Europe, and he was greeted with the publicly expressed admiration of some of the most distinguished of his contemporaries; and the time that has since elapsed has only served to throw an increasing light around his name, which is now sure to retain its distinction so long as the sciences which he loved shall continue to be cultivated among men.

CHAPTER V.

INTELLECTUAL PURSUITS BY MEN OF WEALTH AND STATION CONTINUED:—DRUMMOND OF HAWTHORNDEN; TYCHO BRAHE; TSCHIRNHAUSEN; BOYLE; THE AIR-PUMP; CAVENDISH; OTHER PERSONS OF RANK DISTINGUISHED IN LITERATURE AND SCIENCE.

It would be easy to add to that of Napier a long list of other names of men of wealth and rank, who, in like manner, have devoted themselves to science and literature, in preference to all other pursuits. But we can afford to mention only a very few. One which Napier's naturally suggests to us is that of his contemporary and countryman, William Drummond, of Hawthornden, one of the most elegant poetical writers of the early part of the seventeenth century. Drummond and Napier were neighbours, but probably no record has been preserved of any intercourse between the mathematician and the poet. As the former, however, was resorted to every year by his scientific English friend, Mr. Briggs, so the latter, also, had his visitor from the south, who came to pay his respects to him, from admiration of his kindred genius. In the year 1619, the famous Ben Jonson walked all the way from London to Hawthornden, to see his brother poet, and remained for some time as his guest. Of this visit a curious account is preserved, written by Drummond himself, which has been often printed.* Drummond, who was distinguished for his learning as well as his poetry, died in 1649, in his sixty-fourth year, having lived through a very agitated period without mixing in its political convulsions, satisfied with

* But for the first time correctly and in full under the editorship of David Laing, Esq., for the Shakespeare Society, Lond. 1842.

philosophy and the Muses. Another contemporary of Napier, whose labours and speculations were more similar to his own was the celebrated Danish astronomer Tycho Brahe. Brahe's family was both wealthy and noble; but when he first manifested his attachment to the science by his contributions to which he afterwards acquired so much reputation, being then only a boy at school, his friends did everything they could to check an inclination which they deemed quite unsuited to his birth and prospects; and the young astronomer was obliged to conceal from his tutor the mathematical books he had purchased with his pocket-money, and to read them, as well as to make his observations on the stars, in hours stolen from the time allowed him for sleep. For, even before he was sixteen, he had begun to measure the distances of the heavenly bodies from one another, although he had no better instrument than a common pair of compasses, the hinge of which he used to put to his eye, while he opened the legs until they pointed to the two stars whose relative position he wished to ascertain. A collection of celestial observations made by him at this early period is still preserved at Copenhagen. When he became of age, however, and was his own master, his fortune enabled him to choose his own pursuits; and, having first spent some years in travelling through Germany and Switzerland, and visiting the various observatories in those countries, he then returned home, took up his residence on his estate, and dedicated himself almost entirely to his favourite science. Some of the results of his studies which he published soon drew to them the attention of the learned among his countrymen; and, at the desire of the king, he at last left his retreat to teach astronomy in the capital. But the constant interruptions to which he was here exposed disgusted him with a town life; and he sighed to get once more back to his country retirement. All his wishes in this respect were at length gratified by an

act of extraordinary munificence on the part of his royal master, who bestowed on him the island of Hueen in the Sound, together with a pension of five hundred crowns, a lordship in Norway, and an ecclesiastical benefice, which brought him two thousand crowns more, in order that with these revenues, added to those of his original estates, he might be enabled to prosecute his celestial observations on the grandest scale. In this island, accordingly, Brahe now took up his abode, and soon erected on it a splendid observatory, provided with all the best instruments known in that age. He spent, he says, a hundred thousand crowns of his own money upon its completion, in addition to the produce of his grants from the king. Here he resided for seventeen years, during the whole of which time he continued to devote himself, with unabated zeal, to his scientific pursuits. But such was now his fame, that, even in this retirement, besides being surrounded, as before, by pupils who crowded to profit by his instructions, he was sought out by many visitors, both from his own and foreign countries. Among other persons of distinction who came to see him was our James I., then king of Scotland, who passed a week with him in the year 1590; but, if the story that is told be true, this visit was anything rather than a fortunate incident for Brahe. Some years afterwards, it is said, his protector, Frederick II., being dead, he was visited one day by the young king Christian IV., accompanied by his chief minister, Walckendorf; and it so happened that this latter personage, who was very sensitive and choleric, was barked at, as he approached the house, by two dogs belonging to the astronomer, at which he chose to be so much offended, that he went up to the animals and beat them severely. The dogs had been presented to Brahe by the Scottish monarch; and, irritated at seeing them ill-treated, he interfered to prevent the enraged senator from continuing his chastisement. This gave rise to some high words between

the two, and the result was a quarrel, which Walckendorf, at least, never forgot. From that day, Brahe's ruin was resolved upon by his powerful enemy. A commission was soon after appointed to report upon the public utility of his establishment; and, upon this compliant body declaring that they saw nothing in his splendid observatory but a source of useless expense to the state, a decree was passed recalling all the grants he had received from the former king, and dispossessing him of his island. On this, Brahe determined to bid adieu for ever to his ungrateful country; and, taking with him all his instruments, he retired to Germany. About two years afterwards, however, he was invited to take up his residence at Prague by the Emperor Rodolph II.; and by this prince, who was warmly attached to science, he was provided with a second asylum, almost as splendid as that which he had enjoyed in his native country. But he lived only a very short time after this, having died in 1601, in the fifty-fifth year of his age. Tycho Brahe was the inventor or reviver of a peculiar scheme of the universe, according to which the earth is conceived to be immoveable in the centre of the system, the sun to revolve round it, and the other planets round the sun. It is unnecessary to say that this hypothesis has been long exploded. Indeed, although supported by its author with much ingenuity, it has been generally held to have been a most unphilosophical retrogression from the true system previously established by Copernicus.* But, although Brahe may thus appear to have no very high claims upon our admiration as a theorist, he undoubtedly did much in another way to promote the improvement of astronomy. His extraordinary devotion to

* But see a valuable article on TYCHO BRAHE, in the *Penny Cyclopædia* (vol. v. pp. 323-327), the writer of which declares it to be his opinion, "that the system of Tycho Brahe was the only one of that day not open to serious physical objections, taking as a basis the notions of mechanics [then] admitted by all parties."

the science, of itself, operated as an inspiration upon many of the other ardent minds of the time. But it was by the great number and comparative exactness of his observations, far surpassing anything that had been attained by his predecessors, that he chiefly contributed to the progress of astronomy. No other but one in his circumstances could have commanded either the leisure or the pecuniary means necessary for the making of those observations, which, besides having occupied many years, owed much of their superior accuracy to the excellence and consequent costliness of the instruments which Brahe employed. Here, therefore, was a case in which science was indebted to the wealth of one of its cultivators for services which no zeal or talents could have otherwise enabled him to render.

Another man of fortune, to whom both science and the arts are under considerable obligations, is the German mathematician, TSCHIRNHAUSEN, celebrated for the discovery of the peculiar curve called, after him, Tschirnhausen's Caustics. He was born in 1651, at the seat of his ancestors, in Upper Lusatia; and although, after receiving an excellent education, he entered the army at an early age, he very soon quitted the profession of a soldier, and set out on his travels through England, Italy, and France. He spent several years in traversing these countries, embracing every opportunity of obtaining a knowledge of their arts, manufactures, and productions, and seeking the acquaintance of the learned men of the time, wherever he went. On returning home, he took up his residence on his estate, the revenues of which were ample; and the remainder of his life was given to scientific speculations and experiments. The science of optics was that to which he was chiefly attached; and it was while making some experiments with reflecting mirrors, that he discovered his Caustics, which are curves formed by light reflected in certain circumstances, and are so called from the Greek word for a burning-glass.

They possess some remarkable geometrical properties.* When Tschirnhausen announced this discovery to the French Academy of Sciences, he was only in his thirty-first year; but he was immediately admitted a member of the Academy by order of the King, Louis XIV. In order to have the aid of proper instruments in the prosecution of his researches, he afterwards established three glass-houses in his native district; at which he employed all the resources of his ingenuity in endeavouring to fabricate burning-glasses of greater size and power than any which had ever been elsewhere produced. In 1687 he had made a concave reflecting mirror of copper, of the diameter of four feet and a half, which consumed wood and fused metals at twelve feet distance, in a few seconds; but, although these effects greatly surpassed anything of the same kind that had been accomplished in modern times, he found the inconvenience of operating by reflection so great, that he determined to persevere in his attempts to obtain, if possible, a lens of equal magnitude. He did not exactly attain this object; for the largest lens he succeeded in producing had only a diameter of three feet. But when it is added that nobody but himself had ever before made one of more than four or five inches' diameter, his success will probably be deemed sufficiently extraordinary. The method he employed in fabricating this immense glass is not known. It was convex on both sides, and weighed a hundred and sixty pounds. Although somewhat less in size, its effects greatly exceeded those of the reflector he had formerly used. This lens was purchased from Tschirnhausen by the Duke of Orleans, who afterwards made a present of it to the Academy of Sciences. Tschirn-

* In an article of some length upon Tschirnhausen, in the *Biographie Universelle*, the writer, M. Gley, by a strange blunder, mistakes these curves for actual burning-glasses: and describes, with great minuteness, their wonderful powers in kindling and consuming, or melting, wood, iron, tiles, slates, and earthen-ware!—Vide *Biog. Univ.* xlvii. 3.

hausen deserves, also, to be remembered as the founder of the celebrated porcelain manufactory of Dresden. Before his time it was supposed that the Chinese employed for their porcelain a peculiar earth, only found in their own country: but he discovered that the same species of ware could be manufactured from a compound of different sorts of earth, which might be obtained in Europe as well as in China. This eminent benefactor to the arts, who, beside his contributions to the Transactions of the French Academy, was also the author of two separate works,—the first, entitled The Medicine of the Body, the latter, The Medicine of the Mind, being in fact, a system of the art of reasoning,—died in 1708.

But, perhaps, the best example we can adduce of the manner in which wealth may be made subservient by its possessor, not only to the acquisition of knowledge, but also to its diffusion and improvement, is that of our celebrated countryman, the Honourable ROBERT BOYLE. Boyle was born at Lismore, in Ireland, in 1627, and was the seventh and youngest son of Richard, the first Earl of Cork, commonly called the Great Earl. The first advantage which he derived from the wealth and station of his father was an excellent education. After having enjoyed the instructions of a domestic tutor, he was sent at an early age to Eton. But his inclination, from the first, seems to have led him to the study of things, rather than of words. He remained at Eton only four years, "in the last of which," according to his own statement, in an account which he has given us of his early life, "he forgot much of that Latin he had got, for he was so addicted to more solid parts of knowledge, that he hated the study of bare words naturally, as something that relished too much of pedantry, to consort with his disposition and designs." In reference to what is here insinuated, in disparagement of the study of languages merely as such, we may just remark that the observation

is, perhaps, not quite so profound as it is plausible. So long as one mind differs from another, there will always be much difference of sentiment as to the comparative claims upon our regard of that, on the one hand, which addresses itself principally to the taste or the imagination, and that, on the other, which makes its appeal to the understanding only. But, we are not to suppose that, because the epithet useful is commonly confined to the latter, the former is to be deemed useless. We call that, by way of distinction, useful which is *merely* useful. The agreeable or the graceful is plainly also useful. It is useful and something more. The study of language and style cannot with any propriety be denounced as a mere waste of time; but, on the contrary, is well fitted to become to the mind a source both of enjoyment and of power. So great, indeed, is the influence of diction upon the common feelings of mankind, that no literary work, it may be safely asserted, has ever acquired a permanent reputation and popularity, or, in other words, produced any wide and enduring effect, which was not distinguished by the graces of its style. Their deficiency, in this respect, has been at least one of the causes of the comparative oblivion into which Mr. Boyle's own writings have fallen, and doubtless weakened the efficacy of such of them as aimed at anything beyond a bare statement of facts, even in his own day. It was this especially which exposed some of his moral lucubrations to Swift's annihilating ridicule.

On being brought home from Eton, Boyle, who was his father's favourite son, was placed under the care of a neighbouring clergyman, who, instructing him, he says, "both with care and civility, soon brought him to renew his first acquaintance with the Roman tongue, and to improve it so far that in that language he could readily enough express himself in prose, and began to be no dull proficient in the poetic strain." "Although, however," he adds, "naturally addicted to poetry, he

forbore, in after-life, to cultivate his talent for that species of composition, because, in his travels, having by discontinuance forgot much of the Latin tongue, he afterwards never could find time to redeem his losses by a serious study of the ancient poets." From all this it is evident that the natural bent of his mind did not incline him very strongly to classical studies; and as, for the most obviously wise purposes, there has been established among men a diversity of intellectual endowments and tendencies, and every mind is most efficient when it is employed in accordance with its natural dispositions and predilections, it was just as well that the course of his education was now changed. In his eleventh year he and one of his brothers were put under the charge of a Mr. Marcombes, a French gentleman, and sent to travel on the Continent. In the narrative of his early life, in which he designates himself by the name of Philoretus, Mr. Boyle has left us an account of his travelling tutor. "He was a man," he says, "whose gait, his mien, and outside, had very much of his nation, having been divers years a traveller and a soldier; he was well fashioned, and very well knew what belonged to a gentleman. His natural were much better than his acquired parts, though divers of the latter he possessed, though not in an eminent, yet in a competent degree. Scholarship he wanted not, having in his greener years been a professed student in divinity; but he was much less read in books than men, and hated pedantry as much as any of the seven deadly sins. . . . . . Before company he was always very civil to his pupils, apt to eclipse their failings and set off their good qualities to the best advantage. But in his private conversation he was cynically disposed, and a very nice critic both of words and men; which humour he used to exercise so freely with Philoretus, that at last he forced him to a very cautious and considerate way of expressing himself, which after turned to his no small

advantage. The worst quality he had was his choler, to excesses of which he was excessively prone; and, that being the only passion to which Philoretus was much observed to be inclined, his desire to shun clashing with his governor, and his accustomedness to bear the sudden sallies of his impetuous humour, taught our youth so to subdue that passion in himself, that he was soon able to govern it habitually and with ease."

Under the guidance of this gentleman, who, although not much fitted, apparently, to make his pupils profound scholars, or even to imbue them with a taste for elegant literature, was, probably, very well qualified both to direct their powers of observation and to superintend and assist the general growth of their minds at this early age, the two brothers passed through France to Geneva, where they continued for some time studying rhetoric, logic, mathematics, and political geography, to which were added the accomplishments of fencing and dancing. "His recreations during his stay at Geneva," says Mr. Boyle of himself, "were sometimes mall, tennis (a sport he ever passionately loved), and, above all, the reading of romances, whose perusal did not only extremely divert him, but (assisted by a total discontinuance of the English tongue) in a short time taught him a skill in French somewhat unusual to strangers." The party afterwards set off for Italy; and, after visiting Venice and other places, proceeded to Florence, where they spent the winter.

While residing here, Mr. Boyle made himself master of the Italian language. But another acquisition for which he was indebted to his visit to Florence probably influenced to a greater extent the future course of his pursuits; we mean the knowledge he obtained of the then recent astronomical discoveries of Galileo. This great philosopher died in the neighbourhood of Florence in the beginning of the year 1642, while Boyle and his brother were pursuing their studies in that city. The

young Englishman, who was himself destined to acquire so high a reputation by his experiments in various departments of physical science, some of them the same which Galileo had cultivated, probably never even beheld his illustrious precursor; but we cannot tell how much of Boyle's love of experimental inquiry, and his ambition to distinguish himself in that field, may have been caught from this his accidental residence in early life in a place where the renown of Galileo and his discoveries must have been on the lips of all.

Boyle returned to England in 1644. Although he was yet only in his eighteenth year, he seems to have thought that his education had been long enough under the direction of others, and he resolved for the future to be his own instructor. Accordingly, his father being dead, he retired to an estate which had been left him in Dorsetshire, and gave himself up, we are told, for five years, to the study principally of natural philosophy and chemistry. His literary and moral studies, however, it would appear, were not altogether suspended during this time. In a letter written by him from his retirement to his old tutor, Mr. Marcombes, we find him mentioning, as also among his occupations, the composing of essays in prose and verse, and the study of ethics, "wherein," he says, "of late I have been very conversant, and desirous to call them from the brain down into the breast, and from the school to the house."

These details do not, like many of those we have given in former parts of our work, exhibit to us the ardent lover of knowledge beset with impediments at every step in his pursuit of the object on which he has placed his affections, and having little or nothing to sustain him under the struggle except the unconquerable strength of the passion with which his heart is filled. On the contrary, we have here a young man who has enjoyed from his birth upwards every facility for the improvement of his mind, and is now surrounded

with all the conveniences he could desire for a life of the most various and excursive study. A happy and enviable lot! Yet by how few of those to whom it has been granted, as well as to him of whom we are now speaking, have its advantages been used as they were by him! The truth is, that, if the mind be not in love with knowledge, no mere outward advantages will enable any one to make much progress in the pursuit of it; while, with this love for it, there are no difficulties which the unkindness of fortune can throw in the way of its acquisition that may not be overcome. Sometimes difficulties will even operate as incentives, and the greatest of all difficulties has been when there were none.

In the same letter to Mr. Marcombes which we have just quoted we find Boyle making mention, for the first time, of what he calls "our new Philosophical or Invisible College," some of the leading members of which, he informs his correspondent, occasionally honoured him with their company at his house. This *Invisible College* was the association of learnéd individuals who began about this period to assemble together in London for the purpose of scientific discussion, and whose meetings formed the germ of the Royal Society. According to the account given in a letter written many years after by Dr. Wallis, another member of the club, to his friend Dr. Thomas Smith, it appears that these meetings first began to be held in London, on a certain day in every week, about the year 1645. Mr. Boyle's name does not occur in the list of original members given by Dr. Wallis; but he professes to mention only several of the number. There can be no doubt that Boyle joined them soon after the formation of the association. According to Dr. Wallis, the meetings were first suggested by a Mr. Theodore Haak, whom he describes as a German of the Palatinate, then resident in London. They used to be held sometimes in Wood-

street, at the house of Dr. Goddard, the eminent physician, who kept an operator for grinding glasses for telescopes and microscopes; sometimes at another house in Cheapside; and sometimes in Gresham College, to which several of the members were attached. The subjects of inquiry and discussion are stated to have embraced everything relating to "physic, anatomy, geometry, astronomy, navigation, magnetics, chemics, mechanics, and natural experiments," whatever, in short, belonged to what was then called "the new or experimental philosophy." In course of time, several of the members of the association were removed to Oxford; and they began at last to meet by themselves in that city, while the others continued their meetings in London. The Oxford meetings began to be regularly held about the year 1649. In 1654 Mr. Boyle took up his residence at Oxford, probably induced, in great part, by the circumstance of so many of his philosophical friends being now there, and engaged together in the same inquiries with himself. The Oxford associates, according to Dr. Wallis, met first in the apartments of Dr. Petty (afterwards the celebrated Sir William Petty, the ancestor of the Marquess of Lansdowne), who lodged, it seems, in the house of an apothecary, whose store of drugs was found convenient for their experiments. On Dr. Petty going to Ireland, they next met, the narrative proceeds, "(though not so constantly) at the lodgings of Dr. Wilkins, then warden of Wadham College; and, after his removal to Trinity College in Cambridge, at the lodgings of the honourable Mr. Robert Boyle, then resident for divers years in Oxford." Boyle, indeed, continued to reside in this city till the year 1668. Meanwhile, in 1663, three years after the Restoration, the members of the London club were incorporated under the title of the Royal Society.

It was during his residence at Oxford that Boyle made some of the principal discoveries with which his name

is connected. In particular, it was here that he prosecuted those experiments upon the mechanical properties of the air, by which he first made himself generally known to the public, and the results of which rank among the most important of his contributions to natural science. The first account which he published of these experiments appeared at Oxford in 1660, under the title of 'New Experiments Physico-Mechanical, touching the spring of the air and its effects.' The work is in the form of letters to his nephew, Viscount Dungarvon, the son of the Earl of Cork, which are dated in December 1659. It may be not unnaturally supposed that Boyle's attention was first directed to the subject of Pneumatics when he was engaged at Florence in making himself acquainted with the discoveries of Galileo, whose experiments first introduced anything like science into that department of inquiry. He states, himself, in his first letter to his nephew, that he had some years before heard of a book, by the Jesuit Schottus, giving an account of a contrivance, by which Otto Guericke, Consul of Magdeburg, had succeeded in emptying glass vessels of their contained air, by sucking it out at the mouth of the vessel, plunged under water. He alludes here to Guericke's famous invention of the instrument now commonly called the Air-pump. This ingenious and ardent cultivator of science, who was born at Magdeburg, in Saxony, in the beginning of the seventeenth century, in his original attempts to produce a vacuum, used first to fill his vessel with water, which he then sucked out by a common pump, taking care, of course, that no air entered to replace the liquid. This method was probably suggested to Guericke by Torricelli's beautiful experiment, mentioned in a former chapter, with the barometrical tube, the vacuum produced in the upper part of which, by the descent of the mercury, has been called from him the Torricellian vacuum. It was by first filling it with water that

Guericke expelled the air from the copper globe, the two closely fitting hemispheres comprising which six horses were then unable to pull asunder, although held together by nothing more than the pressure of the external atmosphere. This curious proof of the force, or weight, of the air, which was exhibited before the Emperor Ferdinand III., in 1654, is commonly referred to by the name of the experiment of the Magdeburg hemispheres. Guericke, however, afterwards adopted another method of exhausting a vessel of its contained air, which could be applied more generally than the one he had first employed. This consisted in at once pumping out the air itself. If we suppose a barrel of perfectly equal bore throughout, and having in it a closely fitting-plug or piston, to have been inserted in the mouth of the vessel, it is evident that, when this piston was drawn up from the bottom to the top of the barrel, it would carry along with it all the air that had previously filled the space through which it had passed. Now were air, like water, possessed of little or no expansive force, this space, after being thus deprived of its contents, would have remained empty, and there would have been an end of the experiment. But, in consequence of the extraordinary elasticity of the element in question, no sooner would its original air be lifted by the piston out of the barrel, than a portion of that in the vessel, beyond the piston would flow out to occupy its place. The vessel and the barrel together would now, therefore, be filled by the same quantity of air which had originally been contained in the first alone, and which would consequently be diminished in density just in proportion to the enlargement of the space which it occupied. Although, however, so much of the air to be extracted had thus got again into the barrel, there would still at this point have been an end of the experiment, if no way could have been found of pushing back the piston for another draught, without forcing

also the air beyond it into the vessel again, and thus merely restoring matters to the state in which they were at the commencement of the operation. But here Guericke was provided with an ingenious contrivance —that of the valve; the idea of applying which he borrowed, no doubt, from the common water-pump, in which it had been long used. A valve, which, simple as it is, is one of the most useful and indeed indispensable of mechanical contrivances, is, as most persons know, merely a flap, or lid, moving on a hinge, which, covering an orifice, closes it, of course, against whatever attempts to pass through from behind itself (a force bearing upon it from thence evidently only shutting it closer), while it gives way to and permits the passage of whatever comes in the opposite direction. Now Guericke, in his machine, had two of these valves, one covering a hole in the piston, another covering the mouth of the vessel where the barrel was inserted; and both opening outwards. In consequence of this arrangement, when the piston, after having been drawn out, as we have already described, was again pushed back, the air in the barrel was prevented from getting back into the vessel by the farther valve, now shut against it, while it was at the same time provided with an easy means of escape by the other, through which, accordingly, it passed away. Here then was one barrelful of the air in the vessel dislodged; and the same process had only to be repeated a sufficient number of times, in order to extract as much more as was desired; the quantity, however, that was removed becoming, of course, less every time, inasmuch as, although it filled the same space, it was more attenuated.

The principle, therefore, upon which the first air-pump was constructed was the expansibility of the air, which the inventor was enabled to take advantage of through means of the valve. These two things, in fact, constitute the air-pump; and whatever improvements have been

since introduced in the construction of the machine have gone only to make the working of it more convenient and effective. In this latter respect the defects of Guericke's apparatus, as might be expected, were considerable. Among others with which it was chargeable, it required the continual labour of two men for several hours at the pump to exhaust the air from a vessel of only moderate size; the precautions which Guericke used to prevent the intrusion of air from without, between the piston and the sides of the barrel, during the working of the machine, were both imperfect for that purpose, and greatly added to the difficulties and incommodiousness of the operation; and, above all, from the vessel employed being a round globe, without any other mouth or opening than the narrow one in which the pump was inserted, things could not be conveyed into it, nor, consequently, any experiments made in that vacuum which had been obtained. Boyle, who says that he had himself thought of something like an air-pump before he heard of Guericke's invention, applied himself, in the first place, to the remedying of these defects in the original instrument, and succeeded in rendering it considerably more convenient and useful. At the time when he began to give his attention to this subject, he had Robert Hooke, who afterwards attained a distinguished name in science, residing with him as an assistant in his experiments; and it was Hooke, he says, who suggested to him the first improvements in Guericke's machine. These, which could not easily be made intelligible by any mere description, and which, besides, have long since given way to still more commodious modifications of the apparatus, so that they possess now but little interest, enabled Boyle and his friends to carry their experiments with the new instrument much farther than had been done by the Consul of Magdeburg. But, indeed, Boyle himself did not long continue to use the air-pump which he describes in his first publication. In the second part

of his Physico-Mechanical Experiments he describes one of a new construction; and, in the third part of the same work, one still farther improved. This last, which is supposed to have been also of Hooke's contrivance, had two barrels moved by the same pinion-wheel, which depressed the one while it elevated the other, and thus did twice as much work as before in the same time. The air-pump has been greatly improved since the time of Boyle by the Abbé Nollet, Gravesande, Smeaton, Prince, Cuthbertson, and others.

By his experiments with this machine Boyle made several important discoveries with regard to the air, the principal of which he details in the three successive parts of the work we have mentioned. Having given so commodious a form and position to the vessel out of which the air was to be extracted (which, after him, has been generally called the receiver, a name, he says, first bestowed upon it by the glassmen) that he could easily introduce into it anything which he wished to make the subject of an experiment, he found that neither flame would burn nor animals live in a vacuum, and hence he inferred the necessity of the presence of air both to combustion and animal life. Even a fish, immersed in water, he proved, would not live in an exhausted receiver. Flame and animal life, he showed, were also both soon extinguished in any confined portion of air, however dense, although not so soon in a given bulk of dense as of rarefied air; nor was this, as had been supposed, owing to any exhalation of heat from the animal body or the flame, for the same thing took place when they were kept in the most intense cold, by being surrounded with a frigorific mixture. What he chiefly sought to demonstrate, however, by the air-pump was the extraordinary elasticity, or spring, as he called it, of the air. It is evident, from the account that has been given of the principle of this machine, that, if the pump be worked ever so long, it never can produce in the receiver a

strictly perfect vacuum; for the air expelled from the barrel by the last descent of the piston must always be merely a portion of a certain quantity, the rest of which will be in the receiver. The receiver, in truth, after the last stroke of the piston, is as full of air as it was at first; only that by which it is now filled is so much rarefied and reduced in quantity, although it occupies the same space as before, that it may be considered as, for most practical purposes, annihilated. Still a certain quantity, as we have said, remains, be it ever so small; and this quantity continues, just as at first, to be diffused over the whole space within the receiver. From this circumstance Boyle deduced some striking evidences of what seems to be the almost indefinite expansibility of the air. He at last actually dilated a portion of air to such a degree that it filled, he calculated, 13,679 times its natural space, or that which it occupied as part of the common atmosphere. But the usual density of the atmosphere is very far from being the greatest to which the air may be raised. It is evident that, if the two valves of the air-pump we have already described be made to open inwards instead of outwards, the effect of every stroke of the piston will be, not to extract air from the receiver, but to force an additional quantity into it. In that form, accordingly, the machine is called a forcing-pump, and is used for the purpose of condensing air, or compressing a quantity of it into the smallest possible space. Boyle succeeded, by this method, in forcing into his receiver forty times its natural quantity. But the condensation of the air has been carried much farther since his time. Dr. Hales compressed into a certain space 1522 times the natural quantity, which in this state had nearly twice the density, or, in other words, was nearly twice as heavy as the same bulk of water. Of the air thus condensed by Dr. Hales, therefore, the same space actually contained above twenty millions of times the quantity which it would have done of that

dilated to the highest degree by Mr. Boyle. How far do these experiments carry us beyond the knowledge of Aristotle, who held that the air, if rarefied so as to fill ten times its usual space, would become fire!

We have dwelt the longer upon these details, both as referring to some of the most important contributions for which science is indebted to Mr. Boyle, and because they serve to continue the brief sketch of discoveries relating to the air which we have given in a previous chapter. On leaving Oxford, in 1668, Boyle came to London, and here he continued to reside during the remainder of his life. Up to this time his attendance at the meetings of the Royal Society had been only occasional, but he was now seldom absent. Science, indeed, was as much the occupation of his life as if it had been literally his business or profession. No temptations could seduce him away from his philosophical pursuits. Belonging, as he did, to one of the most powerful families in the kingdom—having no fewer than four brothers in the Irish peerage, and one of them also an English peer,—the highest honours of the state were open to his ambition if he would have accepted of them. But so pure was his love of science and learning, and, with all his acquirements, so great his modesty, that he steadily declined even those worldly distinctions which might be said to lie strictly within the sphere of his pursuits. He was zealously attached to the cause of religion, in support of which he wrote and published several treatises; but he would not enter the church, although pressed to do so by the king, or even accept of any office in the universities, under the conviction that he should more effectually serve the interests both of religion and learning by avoiding everything which might give him the appearance of being their hired or interested advocate. He preferred other modes of showing his attachment, in which his wealth and station enabled him to do what was not in the power of others.

He allowed himself to be placed at the head of associations for the prosecution of those objects which he had so much at heart; he contributed to them his time, his exertions, and his money; he printed, at his own expense, several editions of the Scriptures in foreign languages for gratuitous distribution; if learned men were in pecuniary difficulties his purse was open to their relief. And, as for his own labours, no pay could have made them more zealous or more incessant. From his boyhood till his death he may be said to have been almost constantly occupied in making philosophical experiments; collecting and ascertaining facts in natural science; inventing or improving instruments for the examination of nature; maintaining a regular correspondence with scientific men in all parts of Europe; receiving the daily visits of great numbers of the learned both of his own and other countries; perusing and studying not only all the new works that appeared in the large and rapidly widening department of natural history and mathematical and experimental physics, including medicine, anatomy, chemistry, geography, &c., but many others, relating especially to theology and oriental literature; and, lastly, writing so profusely upon all these subjects, that those of his works alone which have been preserved and collected, independently of many others that are lost, fill, in one edition, six large quarto volumes. So vast an amount of literary performance, from a man who was at the same time so much of a public character, and gave so considérable a portion of his time to the service of others, shows strikingly what may be done by industry, perseverance, and such a method of life as never suffers an hour of the day to run to waste.

In this last particular, indeed, the example of Mr. Boyle well deserves to be added to those of the other great men we have already mentioned. Of his time he was, from his earliest years, the most rigid economist;

and he preserved that good habit to the last. Dr. Dent, in a letter to Dr. Wotton, tells us that "his brother, afterwards Lord Shannon (who accompanied him on his continental tour with Mr. Marcombes), used to say, that, even then, he would never lose any vacant time; for, if they were upon the road and walking down a hill, or in a rough way, he would read all the way; and, when they came, at night, to their inn, he would still be studying till supper, and frequently propose such difficulties as he met with in his reading to his governor." The following naïve statement, too, which we find in an unfinished essay on a theological subject, which he left behind him in manuscript, and of which Dr. Birch, the editor of his collected works, has printed a part, may serve to show the diligence with which he prosecuted his severer studies, even amidst all sorts of interruptions. "It is true," he writes, "that a solid knowledge of that mysterious language" [it is his acquisition of the Hebrew tongue to which he refers] "is somewhat difficult, but not so difficult but that so slow a proficient as I could, in less than a year, of which not the least part was usurped by frequent sicknesses and journeys, by furnaces, and by (which is none of the modestest thieves of time) the conversation of young ladies, make a not inconsiderable progress towards the understanding of both Testaments in both their originals." But the life of active and incessant occupation which he led, even in his declining years, is best depicted in another curious document which Dr. Birch has preserved. A few years before his death he was urged to accept the office of President of the Royal Society, of which he had so long been one of the most active and valuable members, and the Transactions of which he had enriched by many papers of great interest; but he declined the honour on the score of his growing infirmities. About this time he also published an advertisement, addressed to his friends and acquaintances, in which he begins by remarking

"that he has, by some unlucky accidents, had many of his writings corroded here and there, or otherwise so maimed" (this is a specimen of the pedantic mode of expression of which Mr. Boyle was too fond), "that, without he himself fill up the *lacunæ* out of his memory or invention, they will not be intelligible." He then goes on to allege his age and his ill-health as reasons for immediately setting about the arrangement of his papers, and to state that his physician and his best friends have "pressingly advised him against speaking daily with so many persons as are wont to visit him;" representing it as that which must "disable him for holding out long." He, therefore, intimates that he means in future to reserve two days of the week to himself, during which, "unless upon occasions very extraordinary," he must decline seeing either his friends or strangers, "that he may have some time both to recruit his spirits, to range his papers, and fill up the *lacunæ* of them, and to take some care of his affairs in Ireland, which are very much disordered, and have their face often changed by the public disorders there." He at the same time ordered a board to be placed over his door, giving notice when he did and when he did not receive visits.

Nothing can set in a stronger light than this the celebrity and public importance to which he had attained. His reputation, indeed, had spread over Europe; and he was the principal object of attraction to all scientific strangers who visited the English metropolis. Living, as it was his fortune to do, at what may be called only the dawn of modern science, Boyle perhaps made no discovery which the researches of succeeding investigators in the same department have not long ere now gone far beyond. But his experiments, and the immense number of facts which he collected and recorded, undoubtedly led the way to many of the most brilliant results by which, since his day, the study of nature has been crowned. Above all, he deserves to be

regarded as one of the principal founders of our modern chemistry. That science, before his time, was little better than a collection of dogmas, addressing themselves rather to the implicit faith of men than either to their experience or their reason. These venerable articles of belief he showed the necessity of examining, in reference to their agreement with the ascertained facts of nature; and, by bringing them to this test, exposed the falsehood of many of them. His successors have only had to contribute each his share in building up the new system; he had also to overthrow the old one.

Mr. Boyle died, at the age of sixty-four, in 1691. The experimental science of modern times has never had a more devoted follower; and he claims to be recorded, as having not only afforded us an illustrious example of the ardent pursuit of philosophy in a man of rank, but as having dedicated to its promotion the whole advantages of which his station and fortune put him in possession, with a zealous liberality that has scarcely been surpassed or equalled. Other wealthy patrons of literature and science have satisfied themselves with giving merely their money, and the *éclat* of their favourable regard, to the cause which they professed to take under their protection; but he spent his life in the active service of philosophy, and was not more the encourager and supporter of all good works done in that name than a fellow-labourer with those who performed them. For the long period during which he was, in this country, the chief patron of science, he was also and equally its chief cultivator and extender. He gave to it not only his name, his influence, and his fortune, but his whole time, faculties, and exertions.

There is another distinguished name connected with the more recent history of physical science in our own country, which ought not to be omitted under our present head;—we mean that of the late HENRY CAVENDISH. Mr. Cavendish was the son of Lord Charles

Cavendish, brother of the third Duke of Devonshire, and was born in 1731. He was sent, when young, to a school, then of some celebrity, at Hackney, and he afterwards went to Cambridge; but it is believed that he derived his taste for science chiefly from his father, who was not only in the habit of amusing himself with philosophical experiments, but was a good mathematician, and is the author of some determinations with regard to the phenomena of the barometer, of considerable value and importance. Lord Charles Cavendish survived to the year 1783, when he had reached the age of eighty, and was the senior member of the Royal Society. His son had early shown an attachment to scientific pursuits, to which, indeed, he had resolved to dedicate his life, and to sacrifice every other object of ambition, at a time when he had but the prospect of a very moderate patrimony. It was only after he had passed his fortieth year that he came into the possession of his large fortune, which was unexpectedly left him by an uncle. He was admitted a Fellow of the Royal Society in 1760, and very soon began to distinguish himself as one of the most active members of that learned body. The papers with which he continued to enrich the Transactions extend over a period of nearly fifty years; and are marked throughout by an accuracy, elegance, and often an originality of investigation, which make them models of scientific research and reasoning. His contributions to pneumatic chemistry, in particular, the first portion of which was published in 1766, must be ranked among the most important that had yet been made to chemical science. And, if we may no longer assign to him the undisputed glory of the great discovery of the composition of water,—so long regarded by all as a perfectly simple element, if there was any such in nature, but now ascertained to be a compound of two airs, or gases, oxygen and hydrogen (or as it was formerly called inflammable air)—he will certainly for ever be remembered

as the chief author of the experimental investigation which led to it. The manner, too, in which he proceeded in this inquiry affords us one of the most beautiful and instructive examples on record of the right method of examining nature,—of that cautious and scrutinising observation by which alone truth is to be detected. Other chemists, Macquer, and afterwards Lavoisier in France, Scheele in Sweden, Volta in Italy, as well as Priestley in England, had all previously performed experiments which, if they had only been conducted with the requisite care, could not have failed to lead to the same results which Cavendish obtained. His, which in the first instance were repetitions of some of Priestley's, were commenced in the early part of the year 1781, with an apparatus and with precautions especially adapted for ascertaining the precise weight of the two gases and of whatever their combination might produce. The result was, that, when they were set on fire by an electric spark in a close and perfectly dry vessel, a deposit was left on the sides of the vessel, which was found to be pure water, *and to be exactly equal in weight to the two gases.* The experiment was afterwards repeated by Lavoisier on a larger scale with the same result; and water, on the other hand, has since been decomposed into oxygen and hydrogen.*

* A keen controversy has been carried on of late years on the question of whether the great discovery of the composition of water really belongs to Cavendish or to his celebrated contemporary James Watt. The claim in favour of Watt was first publicly advanced by the late M. Arago, in an *Eloge* on Watt read by him before the French Academy of Sciences, 8th December, 1834, and afterwards published in the *Annuaire of the Bureau of Longitude* for 1839, with an Appendix by Lord Brougham, entitled "An Historical Account of the Discovery of the Composition of Water." There are two English translations of M. Arago's *Eloge;* the first published at Edinburgh in 1839, the other published at London the same year, with additional Notes and an Appendix, by James Patrick Muirhead, M.A., Oxford. These publications were followed on the same side by an account of Watt in the First Series of Lord Brougham's *Lives of Men of Science of the Time of George III.*, 1845, and "The Correspondence of the late James Watt on his Discovery

The great caution with which Mr. Cavendish conducted his inquiries was one of the most distinguishing characteristics of his method of procedure. To whatever

of the Composition of Water; with a Letter from his son: edited, with Introductory Remarks and an Appendix, by J. P. Muirhead," 1846. Meanwhile Mr. Cavendish's claim had been elaborately and strenuously defended in an "Address to the Meeting of the British Association held at Birmingham, 26th August, 1839," by the President, the Rev. William Vernon Harcourt; which was afterwards published in the 8th volume of the Reports of the Association, and also separately, with a Postscript, in the following year. The same view was taken by the Rev. Dr. Whewell, now Master of Trinity College, Cambridge, in the first Volume of his *Philosophy of the Inductive Sciences*, 1840, and in an article in the *Quarterly Review*, No. 153, for December, 1845, understood to be by the Rev. Dr. Peacock, Dean of Ely. On the opposite side, again, or in assertion of Watt's claim, there appeared articles in the *Edinburgh Review*, No. 142 (for January, 1842), No. 150 (for January, 1844), and No. 153, (for December, 1845), the last by the late Lord Jeffrey; and also an article in the *North British Review*, No. 11 (for November, 1846), understood to be by Sir David Brewster. But by far the most thorough and conclusive investigation that the question has received will be found in the Life of Cavendish drawn up by Dr. George Wilson of Edinburgh (now Professor of Chemistry in the University), and printed for the Cavendish Society in 1851. Of this volume, extending to nearly 500 pages, more than half is occupied with a "Critical Inquiry into the Claims of all the alleged Discoverers of the Composition of Water."

It is to be observed that what is claimed for Watt is merely the merit of having been the first to perceive the full import of Cavendish's decisive experiment; and his statement to that effect, made in letters to Dr. Priestley, Dr. Black, and Mr. Hamilton of Glasgow, in April 1783, is certainly the earliest on record. It is further highly probable that he had for some considerable time before this anticipated the possibility that water would be found to be resolvable into certain kinds of air. But it is not pretended that he either made or suggested any of the experiments by which the great truth was proved. These were all devised and performed by Cavendish. Such being the case, perhaps some difference of opinion may fairly be expected to prevail in regard to the real amount of Watt's share in the discovery even if we disregard the objections that have been made to the absolute correctness of his theory or interpretation of Cavendish's experiments. But that Cavendish needed Watt's interpretation to enlighten him as to the meaning of his own experiments seems to be quite an unnecessary supposition. Cavendish's account of his experiments was read before the Royal Society on the 15th of January, 1784; and his paper and another by Watt were published together in the Transactions for that year.

subject he gave his attention, he examined it thoroughly. What we have just stated is well calculated to show the value of such a habit in philosophy; for this great discovery, of itself enough to immortalise his name, would have eluded him, as it had done others, if he had not watched the experiment which revealed it more narrowly than they. But it was not in this case only that the result of his investigations richly rewarded the care and circumspection with which they had been prosecuted, The patience with which he used to review and weigh all the circumstances of the case to be resolved has given a perfection to whatever he has done, from which as much benefit has resulted to the interests of science as to his own fame; for, instead of merely vague and imperfect indications, or hypotheses consisting half of truth and half of error, he has in this way bequeathed to philosophy either completed discoveries or investigations in which, so far as they go at least, there is no fallacy. He never, it has been remarked, advanced anything in any of his papers which he had afterwards to retract.

Although experimental science was Mr. Cavendish's favourite pursuit, and that on his success in which his fame rests, his stores of information upon other subjects were known to his friends to be various and extensive. "He was," we are told by one of the writers in the controversy in regard to the great discovery so long popularly associated with his name, "familiar with nearly every branch of physical science; a great chemist, a great electrician, a magnetist, and a meteorologist: his views of geology . . . were greatly in advance of his age, and had led him to a very considerable knowledge of the true succession of the strata of Great Britain, founded chiefly upon a consideration of their mineral structure and character, at a period when this science, in other hands, was a prey to the most extravagant theories altogether independent of observation: his knowledge of mathematics was equal, if not superior, to that of any of his

countrymen: he was equally learned and skilful as a practical and as a theoretical astronomer: if a comet or a planet, such as Uranus, was observed, it was Mr. Cavendish who calculated its elements: if a great astronomical phenomenon was expected, such as the transit of Venus over the disk of the sun in 1769, it was Mr. Cavendish who discussed the character of the observations to be made, and their results when obtained: his knowledge of the theory and use of astronomical and other instruments was superior to that of any other philosopher of his age, and he was singularly skilful and ingenious in the contrivance and construction of chemical and philosophical apparatus: to all these various accomplishments, he united the most cautious habits of reasoning, and never committed himself to a conclusion which his experiments and observations did not appear fully to justify."*

Mr. Cavendish, indeed, spent his life, if any man ever did, in the pursuit of knowledge, making it his only amusement, as well as his only business. The simple and unexpensive habits of life which he had formed in his earlier years underwent no change on his coming into possession of his large fortune. He had accustomed himself from his youth to the utmost regularity in all his movements; and his practice in this respect, to his last days, nothing was ever suffered to derange. What might be called his public scene was the Royal Society, the meetings of which he attended punctually as long as his strength permitted. With this exception, he was but little seen abróad; and, perhaps, the seclusion in which he lived made his name less popularly known in his own country than it would otherwise have been, notwithstanding his eminent merits. His fame, however, was more than British—it was European. On the Continent, where he was regarded without reference to his private

Quarterly Review, lxxvii. 114.

habits and only as the author of many admirable scientific disquisitions and of some great discoveries, his name stood very high. The chief men of science in France gave the strongest proof of the estimation in which they held him, when, in 1803, they elected him one of the eight Foreign Associates of the Institute.

One valuable service which Mr. Cavendish's wealth enabled him to render to the students of science and literature of his time was the establishment of an extensive library, which, with great liberality and public spirit, he threw open for the accommodation both of his friends and of all other persons engaged in intellectual pursuits who were properly recommended to him—allowing them not only to consult the books, but to carry them home. In the use of this privilege he made no distinction between himself and those whom he admitted to share it with him. When he wanted a book for his own perusal, the same application for it was made to the librarian, and the same receipt given for it, as if it had been borrowed by any other reader. Towards the close of his life, after the death of the person who had been accustomed to take charge of the collection, he even used to attend himself on a certain day of every week to give out the books to applicants.

This eminent person died in 1810, full of years and honours. Even in his last moments something of his love of watching and scrutinising the phenomena of nature showed itself; he insisted upon being left to die alone, apparently that he might be able to observe the symptoms of approaching dissolution with the more undisturbed attention. Accordingly, when his servant, whom he had sent out of the room, returned sooner than he had desired, he immediately ordered him again to retire; and, when the man came back the second time, he found that his master had breathed his last. In his attachment to philosophy, Mr. Cavendish was all his life so independent of other sources of pleasure, that his

fortune, rather possessed than enjoyed, and not expended in the maintenance of any of the show and luxury in which a large revenue usually dissipates itself, had accumulated so greatly, that at the time of his death it is said to have amounted to twelve hundred thousand pounds. He may well be described, therefore, to have been, as a French writer has quaintly expressed it, the richest of all the learned of his time, as well as probably the most learned of all the rich.*

These histories are abundantly sufficient to prove both how frequently men of wealth and rank have resisted all other allurements in order to devote themselves to intellectual pursuits, and how many important contributions such persons have been enabled to make to literature, science, and the arts. Yet it would be easy to add many other examples from a very cursory survey of the annals of improvements and discoveries. Thus, to confine ourselves to the arts and sciences only, we might mention, among our own countrymen, the celebrated MARQUESS OF WORCESTER, author of the Hundred Inventions, among which we find the first suggestion of the steam-engine; his contemporary, VISCOUNT BROUNCKER, the first President of the Royal Society, and noted as the perfecter of the theory of fractional arithmetic; the second EARL OF MACCLESFIELD, to whom we are chiefly indebted for the reformation of the calendar, and the introduction of the New Style into England; the third EARL STANHOPE, the inventor of the printing press known by his name, as well as of many other ingenious and valuable contrivances;—and various others, all memorable either as inventors, or as the authors of some decided step in the progress of improvement. Among foreigners, too, there is PRINCE RUPERT, to whom, as already noticed, there has been attributed the discovery of the art of mezzotinto engraving. BARON HERMELIN, a

* M. Biot, in *Biographie Univ.* vii. 456.

nobleman of Sweden, who died in 1820, was the father of the modern and greatly improved system of working the mines of that country, which he expended many years of exertion and large sums of money in introducing and establishing. The modern art of fortification is the creation of the French MARSHAL VAUBAN, a man of rank and wealth, who, although he spent his life as a soldier, found leisure to write numerous works, which have been printed, as well as twelve large volumes in manuscript which he left behind him, entitled 'Mes Oisivetés' (*My Idle Hours*). The most elaborate and elegant work on Natural History that was ever written, and the one which, notwithstanding some serious defects and errors, has perhaps contributed more than any other to spread a taste for that science, was the production of another French nobleman, the celebrated COUNT DE BUFFON. A German nobleman, the BARON VON CANSTEIN, is noted for having discovered and practised at Halle, in the beginning of the last century, a new mode of printing, which appears to have been the same with that now called stereotype. This invention is singular for its vicissitudes of notoriety and oblivion. The Chinese have had a long acquaintance with the art of printing from blocks or plates, instead of moveable types, and among them it is to this day the only method in use. It was probably also the first form which the art of printing assumed in Europe,—was then forgotten for many years, till it was revived in the middle of the sixteenth century at Augsburg, where some of the plates that were used for the purpose are still preserved,—was again introduced at Leyden about half a century later, —was a few years after reinvented by Canstein,—was practised at Edinburgh in 1744 by William Ged, who was quite ignorant of what had been done by his predecessors,—and, lastly, after his attempts had ceased to be remembered, was taken up anew by the late ingenious Dr. Alexander Tilloch, and Fowlis, the Glasgow

printer, who, however, did little more than merely take out a patent for what they deemed their discovery. These block or plate printers, however, did not all pursue the same method. Faust, for instance, on the invention of printing, employed merely wooden blocks, such as are used by the Chinese, on which the characters were cut out, as is done still in wood-engraving; the Augsburg printers appear to have set up their types in the usual manner, and then to have converted them into a solid plate by pouring melted metal upon the back of the congeries; and the present method, as is well known, is, after having set up the types, to take an impression from them in plaster of Paris, or some other composition, and to cast or found the plate in this as a mould. It does not very clearly appear what was the plan which Canstein followed; but it is known that he printed a great many volumes and sold them very cheap. A copy of the New Testament, for instance, he used to sell for fourpence; but, as he was very pious, it is not improbable that he distributed the Scriptures at less even than the cost price, which his fortune enabled him to do. It is said that it was while endeavouring to devise a cheap method of multiplying copies of the Bible for the use of the poor, that the notion of his invention suggested itself to him.

CHAPTER VI.

SELF-EDUCATED CULTIVATORS OF SCIENCE:—PARKES; DAVY.

Most of the individuals we have mentioned, who, born to rank and affluence, have devoted themselves to scientific pursuits, were enabled to accomplish what they did, in a great measure, from the peculiar advantages of their position, which afforded them both leisure for the prosecution and maturing of their several schemes, and money to expend on the necessary apparatus and experiments. This proves to how much profit the rich man may turn his fortunate external circumstances, even in the pursuit of knowledge, if he can only rouse himself to enter with earnestness upon that enterprise. But still the ambition of aspiring minds, left to struggle unassisted by such external aids, has accomplished, after all, quite as great things as all the resources and immunities of what might be deemed the happiest worldly lot have ever given birth to. We now return to accompany for a while the onward steps of a few more of those courageous adventurers who have begun and carried on the work of mental cultivation without heeding any combination of worldly disadvantages against which they might have to contend. We shall begin with the cases of one or two individuals so situated, who have distinguished themselves in that same field of experimental science in which we have just seen what Boyle and Cavendish achieved in their very opposite circumstances.

The first name we shall mention is that of one who

has no claim, we believe, to any important discovery in the department which he cultivated, but whose literary works, nevertheless, as well as his history, abundantly testify him to have been a most ingenious and meritorious man. We speak of the late MR. SAMUEL PARKES, the well-known author of the 'Chemical Catechism.' Mr. Parkes, as we learn from a communication with which we have been favoured by his surviving daughter, was born in 1761, at Stourbridge, in Worcestershire, where his father was a small grocer. At five years of age he was sent to a preparatory school in his native town; and it is remembered that, during the time of his attendance at this infant seminary, Mr. Kemble's company of itinerant players having visited Stourbridge and remained there for some months, that gentleman placed his daughter at the same school, the child who became afterwards the celebrated Mrs. Siddons. When ten years old, Parkes was sent to another school at Market-Harborough; but, after remaining here only a very short time, he was taken away and apprenticed to a grocer at Ross, in Herefordshire. This person happened to be a man of some education, and to be possessed of a few books, which he very kindly lent to his apprentice; but, although he endeavoured to give him a taste for reading, he could not, it is said, gain much of his attention. It does not appear how long young Parkes continued in this situation; but at last his master failed, and he returned home to his father. We now hear no more of him till he had reached his thirty-second year, up to which time, it seems, he remained at home, assisting his father in the shop. It is probable, from the resources he afterwards displayed, that the foundation of many of his acquirements was laid during this interval. Perhaps he had also saved a little money; for he now went to Stoke-upon-Trent, began business on his own account as a soap-boiler, and married. The new line upon which he entered shows that he had been

already directing his attention to practical chemistry. But, after persevering for ten years in this business, he met with so little success as to be obliged to give it up; and at the age of forty-two he came up to London with no property in the world except ten pounds, which had been lent him by his father. It was hard enough to be obliged, as it were, to begin the world again at this time of life; but there was no help for it, and he set to work resolutely. Some friends whom he had made lent him a little assistance, and he began manufacturing muriatic acid for the use of dyers. It is very evident, that, although he had come to town without much money in his pocket, he had brought with him some useful knowledge—one fruit, at least, of the labours of his previous life, of which fortune had not been able to despoil him. This he now turned to excellent account. To his muriatic acid he soon added other chemical preparations, his skill in manufacturing which was not long in being generally appreciated, and eventually procured him a large trade and a high reputation.

Although Mr. Parkes had probably given considerable attention to some of the practical parts of chemistry before he came up to London, it was only after he had established himself in this last-mentioned line of business that he began to study the subject scientifically. At this time, as we have seen, he was above forty years of age—so that he may be quoted as another most encouraging example for those who have been prevented by any cause from commencing their studies till late in life. Notwithstanding the time he had lost, Mr. Parkes became eventually a most accomplished chemist, and gave to the world a succession of works relating to that science which long continued to hold the rank of text-books of high authority. The earliest of these was his 'Chemical Catechism,' which first appeared in 1805. It was translated, soon after its publication, into the German, French, Spanish, and Russian languages. By

this work alone, of which numerous large editions were printed, the author realised 5000*l*. The Catechism was followed by another work, 'The Rudiments of Chemistry;' and that by the 'Chemical Essays,' in five volumes. This last in particular, is an excellent performance, and strikingly shows the author's extensive acquaintance with his subject. Like their precursor, these two works were also translated into the principal continental languages, and obtained great popularity abroad, as well as in this country. Among other gratifying testimonies which the author received of the sense entertained of his labours, was a splendid ring presented to him for his services to science by the Emperor Alexander I. of Russia.

One of the chief merits of the elementary works published by Mr. Parkes, and what must doubtless more than anything else have helped to make them popular, lies in this; that in all his explanations the author begins at the beginning and nowhere assumes any information necessary for understanding the subject to exist in the mind of the reader beyond what he has himself communicated. It might seem, at first sight, as if this were a part of the art of teaching of no very difficult attainment. Yet the fact is, that it is a secret of which very few writers have made themselves masters. In general, the person who resorts to a professedly elementary treatise, in order to study any branch of science of which he previously knows nothing, finds himself stopped before he has gone very far, by the author paying him the very inconvenient compliment of addressing him as if he were familiar with many things of which he is quite ignorant. Hence, more than on any other account, the uselessness, or at least the insufficiency, of the greater number of such works for the end which they are intended to serve. They almost always suppose the reader to know, before he opens them, no inconsiderable part of the very mystery which

they profess to teach. It sometimes, no doubt, happens that the reader does accidentally possess this requisite preliminary information; and then (though no thanks to the author) he will make his way through the book without being inconvenienced by its deficiencies. In other cases he may have sufficient ingenuity to deduce from what is stated some conjecture more or less vague as to what is passed over, and in this way may be enabled to proceed in his perusal without finding himself absolutely in the dark. But his progress, so conducted, is not only slow, unsatisfactory, and painful, compared to what it might be, but is likely besides to leave him at last only half-informed or misinformed as to many things which he supposes himself to know. Perhaps the best way of employing books of the description to which we allude—when no better are to be had—is for the student to provide himself with two or more at the same time upon the subject of which he wishes to make himself master; so that, when he finds one deficient or unintelligible, he may have a chance of finding an interpreter in another. This is a method which has sometimes been successfully followed by persons who have been obliged to be their own instructors, after every attempt to understand the science, or other branch of education, which it was desired to learn by the assistance of a single author, had proved a failure; and we recommend it to others similarly situated. The probability is, that, of two writers each of whom at times expresses himself obscurely, the one will not always or usually fall into that fault in regard to exactly the same matters as the other; and, therefore, though either alone might be an inadequate instructor, the two together may shed sufficient light on the subject. Besides, of two or more ways of presenting or illustrating the same truth, one mind is most readily reached by one, and another by another; so that, even when no absolute insufficiency can fairly be complained of in

either treatise, the two are still better than one. The force of this last consideration has induced some popular writers of elementary works to state the more difficult parts of their subject in a variety of ways for the sake of more surely impressing them upon the various minds, or moods of mind, they may chance to address; and the practice, when followed judiciously, and so as not to overload the book with unnecessary repetitions, a course which only fatigues the reader and distracts his attention, is one which may be made greatly to contribute to the clear and effective exposition of the author's meaning.

It may seem strange that so many writers should have failed in the observance of a rule of elementary explanation apparently so simple and easy as that in question. What less difficult, it may be said, or even more natural, than, in expounding any subject to a mind which is supposed to be ignorant of its first principles, to state everything with a recollection of, and in accommodation to, that ignorance? It is only, in the first place, to deduce the introductory statements from sufficiently familiar instances, and then, in pursuing the line of inference or demonstration, to advance from one thing to another by sufficiently short steps. But even to do this requires no common degree of attention, patience, and skill. It is true that all science, even the highest and most recondite, is deducible from the facts or feelings of ordinary life; but it often happens that a proficient in a particular science has never viewed it in this connection. The manner in which he was himself taught it did not lead him to do so. He was probably carried through what were called its principles, by an exercise of his faith rather than of his reason; and left to gather a full understanding of them, not so much from what he knew of their foundations before, as from what he was to see of their application afterwards. He was like a man entering a half-darkened apartment, to whom everything is at first invisible, and who is indebted for

the measure of discernment which at last enables him in some sort to distinguish objects, not to any additional light which is thrown upon them from without, but to the expansion of eye which the dimness itself occasions. It may happen that, in the progress of his studies, his partial acquaintance with one part of the subject has so much aided his partial acquaintance with another part, that he has at last attained to a tolerably clear notion of the whole. But still it remains in his head an insulated system of propositions, altogether withdrawn and separated from those truths of ordinary experience out of which, nevertheless, it has wholly sprung. When a person, therefore, who has acquired his knowledge in this manner sits down to write an elementary book, he will be very apt to overlook that connection between scientific and common truths to which his own attention has never been called. He will begin his treatise, not by reference to something which is understood by everybody, but by an announcement so far ahead of everything of this kind, that its meaning is likely to be nearly imperceptible to all except those who have already some acquaintance with the still more remote matters to which it is intended to lead. And his subsequent deductions will all be apt to be characterised by the same absence of the simple and the natural, proceeding as they do from a mind which did not acquire its own knowledge of the subject from contemplating it in its simplest and most natural aspect.

Now, a self-educated man, when he attempts to explain to others what he has himself learned, is much less likely to fall into this error of manner. His own earliest acquaintance with science was probably made by the aid of that unscientific knowledge which common observation teaches every man; and, having no master to supply the deficiencies of his books, he must have felt painfully the inconvenience of their omissions and obscurities. Hence in his own performances a method

and style of address in all respects better suited to readers circumstanced as he himself was. He knows, from his own experience, what the difficulties of such readers are, and is therefore both the more solicitous and the better qualified to provide against them. In making his first approach to the science, he does it through the avenue of certain common and simple facts, calculated to carry with them the apprehension and assent of all; his references are frequent throughout the work to considerations of this class, which are always a valuable excitement and help to the mind; and his progress from one statement to another is marked by a happy skill in so selecting and arranging the intermediate points of notice, or, as we may express it, picking his steps, as to arrive at the ultimate object at once by the easiest and by the shortest road. For it is of importance to remark, that the secret of this art of perspicuous explanation does not lie so much in an exuberant minuteness of detail, which leaves no particular whatever unstated, as in bringing out from the group, and fixing the chief attention on, those comparatively few particulars which, being themselves apprehended, suggest and supply the rest. A prolix and undiscriminating enumeration of all the items of the case is rather adverse to a clear and effective exposition, tending as it does both to weary and confuse the mind. To make the description what it should be, nothing needful should be omitted, and there should also be nothing superfluous.

The elementary treatises of Mr. Parkes possess, as we have said, a good deal of this sort of merit, and owe to that circumstance much of their popularity and usefulness. Those of Ferguson, another self-educated individual, display the same excellence in a still greater degree, and have always, accordingly, been favourites of those students of science who, like the writer, have been their own instructors. We may here observe, however, that the advantages of the question and answer method

pursued in the 'Chemical Catechism' may reasonably be doubted. Where the composition assumes the form of a dialogue or conversation, in which two or more speakers are made, as it were, to examine or discuss the subject, one proposing his doubts or difficulties, which another meets and solves by the proper reasons and explanations, as well exemplified, for instance, in some of Mrs. Marcet's treatises, the meaning and convenience of so breaking down the statements are sufficiently obvious. The attention of young readers especially is, perhaps, better kept alive by such an intermixture of the dramatic; and the artifice is also an ingenious one for enabling the author to notice and correct, in the most natural manner, the various misapprehensions into which the mind is apt to fall on first attempting to make acquaintance with a new subject. But neither of these purposes seems to be, in any degree, answered by merely introducing every sentence or short paragraph throughout the work with a formal interrogatory. Even in a mere school-book, the pupil's ingenuity is best exercised, and his understanding of what he reads most effectually insured, by the questions he should be able to answer being left to be put to him by his teacher, and the answers themselves to be given in his own words. The other plan would seem to be calculated only to assist the pupil in learning his task by rote.

Mr. Parkes, in his latter and more prosperous days, used often to dwell with pleasure on his struggles in early life, and naturally felt proud of relating the hardships he had surmounted by his own industry. The success of the different works he published gave him, as might be supposed, the highest gratification. In addition to the literary performances which we have already mentioned, we ought to notice two pamphlets which he gave to the public in the years 1817 and 1819, in support of the attempt then making, and which was eventually successful, to obtain a repeal of the salt duties. He was

one of the most active of the persons who stirred in this matter, anticipating, as it has been already noticed that the celebrated inventor of the logarithms appears to have done, great advantages to agriculture from the use of salt as a manure. Engaged, as he was, in the management of an extensive chemical manufactory, which required unremitting attention, his hours of literary labour were those which he stole from repose or from the time which most men give to relaxation and amusement. Yet, besides the different books which, in the course of a few years, he published in his own name, he contributed numerous papers to the different scientific periodical works of the day. As another evidence, too, of his punctuality and indefatigable industry, it may be mentioned that he had, from an early age, been in the habit of keeping a regular diary of every action of his life, and never retired to bed till he had committed to writing the events of the day. This, and all his other industrious habits, he kept up to the last; and, even up to within a few days of his death, although he had long been suffering under a painful disease, his attention to business, and especially to his scientific pursuits, continued unrelaxed. He closed his valuable and active life on the 23rd of December, 1825, in the sixty-fifth year of his age.

Neither the acquisition of knowledge, nor that of wealth, then, need be despaired of even by those who have not succeeded in accumulating much of either after a large portion of life has been spent, provided they resolve to employ the requisite industry and perseverance during the remainder of it. These virtues seldom fail to obtain their natural recompense at last; although, in some cases, they may have to struggle for a long time with circumstances very unfavourable to success. A man is sometimes so unfortunately placed, so jammed in and hand-bound by the pressure of an unpropitious lot, that, with his best efforts, it is long

before he can extricate himself and obtain even a fair opportunity of exerting what powers he may possess. This seems to have been the case with Parkes for the first forty years of his life. In the popular phrase, fortune was set against him; he either had no means of engaging in any likely line of well-doing, or whatever he attempted turned out unsuccessful. But, in such a shifting scene as this world is, it can rarely happen that a man shall, during the whole of his lifetime, have the blast against him. As the poet expresses it, "there is a *tide* in the affairs of men," an ebbing and flowing of the unstable element on which they are borne, and if this be only "taken at the flood," the "full sea" is gained on which "the voyage of their life" may be made with ease and the prospect of a happy issue. It is only those, however, who are constantly on the watch for it that will be prepared to seize the lucky moment when it comes; in other words, nothing but the cultivation and continued exercise of habits of industry and perseverance, even while they bring but small or no immediate return, will enable a man to benefit by the most favourable opportunities when they at last present themselves. To the habitually indolent and thoughtless it is the same as if the tide never were at flood at all—for they are sure to miss it when it is. Parkes spent nearly two-thirds of his life in contending with difficulties which baffled all his attempts to overcome them; and others may, sometimes, be for as long a period equally unfortunate. Let such be taught, by his history, that their sky may yet brighten; and, by his example, how to take advantage of it when it does. The space of life that remained to him after his more prosperous career began was comparatively short; but it was long enough to enable him, while he gave the most assiduous attention to business, not only to acquire much knowledge himself, but also to contribute largely to its diffusion in his own and other countries; and to secure,

by his literary works, a highly respectable place among the scientific writers of the time.

But the annals of modern Chemistry supply us with a much more splendid name among the self-taught cultivators of the science. The discoveries of all his predecessors have been, in our own day, surpassed in brilliancy by those of Sir HUMPHRY DAVY. Davy was born in 1778, at Penzance, in Cornwall. His father followed the profession of a carver in wood in that town, where many of his performances are still to be seen in the houses of the inhabitants. Young Davy was taught the rudiments of classical learning at a seminary in Truro. He was then placed by his father with an apothecary and surgeon in his native place. But, instead of attending to his profession, he spent his time either in rambling about the country or in experimenting in his master's garret, sometimes to the no small danger of the whole establishment; and the doctor and he at last agreed to part. About his fifteenth year he was placed as pupil with another surgeon residing at Penzance; but it does not appear that his second master had much more success than his first in attempting to give him a liking for the medical profession. The future philosopher, however, had already begun to apply, of his own accord, to those sciences in which he afterwards so greatly distinguished himself; and, proceeding upon a plan of study which he had laid down for himself, he had, by the time he was eighteen, obtained a thorough knowledge of the rudiments of natural philosophy and chemistry, as well as made some proficiency in botany, anatomy, and geometry. The subject of metaphysics, it is stated, was also embraced in his reading at this period.

But chemistry was the science to which, of all others, he gave himself with the greatest ardour; and, even in this early stage of his researches, he seems to have looked forward to fame from his labours in this department. The writer of the memoir of Sir Humphry, to

which we are indebted for these particulars,* quotes an exclamation which broke from him one day in after-life, when contemplating, along with a friend, a picture of one of the mines of his native district, which shows what were the visions of his solitary rambles. "How often, when a boy," said he, "have I wandered about those rocks in search after new minerals, and, when tired, sat down upon those crags, and exercised my fancy in anticipations of future renown!" The peculiar features of this part of the country doubtless contributed not a little to give his genius the direction it took. The mineral riches concealed under the soil formed alone a world of curious investigation. The rocky coast presented a geological study of inexhaustible interest. Even the various productions cast ashore by the sea were continually affording new materials for examination to his inquisitive and reflecting mind. The first original experiment, it is related, in which he engaged, had for its object to ascertain the nature of the air contained in the bladders of sea-weed. At this time, he had no other laboratory than what he contrived to furnish for himself, by the assistance of his master's phials and gallipots, the pots and pans used in the kitchen, and such other utensils as accident threw in his way. These he converted, with great ingenuity, to his own purposes. On one occasion, however, he accounted himself particularly fortunate in a prize which he made. This was a case of surgical instruments with which he was presented by the surgeon of a French vessel that had been wrecked on the coast, to whom he had done some kind offices. Examining his treasure with eagerness, Davy soon perceived the valuable aid he might derive in his philosophical experiments from some of the articles; and one of the principal of them was, in no long time, converted into a tolerable air-pump. The proper use of the in-

* Originally published in the 'Spectator' newspaper.



SIR HUMPHRY DAVY.

struments was, of course, as little thought of by their new possessor as that of his master's gallipots was wont to be when he had got them up to his garret. Davy's subsequent success as an experimentalist, it is well remarked by the writer to whom we have referred above, was probably owing, in no small degree, to the necessity he was placed under in his earliest researches of exercising his skill and ingenuity in this fashion. "Had he," proceeds his biographer, "in the commencement of his career been furnished with all those appliances which he enjoyed at a later period, it is more than probable that he might never have acquired that wonderful tact of manipulation, that ability of suggesting expedients, and of contriving apparatus so as to meet and surmount the difficulties which must constantly arise during the progress of the philosopher through the unbeaten tracks and unexplored regions of science. In this art Davy certainly stands unrivalled; and, like his prototype, Scheele, he was unquestionably indebted for

his address to the circumstances which have been alluded to: there never, perhaps, was a more striking exemplification of the adage, that necessity is the parent of invention."

A curious catalogue might be made of the shifts to which ingenious students in different departments of art have resorted, when, like Davy, they have wanted the proper instruments for carrying on their inquiries or experiments. His is not the first case in which the stores of an apothecary's shop are recorded to have fed the enthusiasm and materially assisted the labours of the young cultivator of natural science. The German chemist, Scheele, who has just been mentioned, and whose name ranks in his own department with the greatest of his time, was, as well as Davy, apprenticed in early life to an apothecary. While living in his master's house he used secretly to prosecute the study of his favourite science by employing often half the night in reading the works that treated of it, or making experiments with instruments fabricated, as Davy's were, by himself, and out of equally simple materials. Like the young British philosopher, too, Scheele is recorded to have sometimes alarmed the whole household by his detonations;—an incident which always brought down upon him the severe anger of his master, and heavy menaces intended to deter him from ever again applying himself to such dangerous studies, which, however, he did not long regard. It was at an apothecary's house, as has been noticed in a preceding page, that Boyle and his Oxford friends first held their scientific meetings, induced, as we are expressly told, by the opportunity they would thus have of obtaining drugs wherewith to make their experiments. Newton lodged with an apothecary, while at school, in the town of Grantham; and as, even at that early age, he is known to have been ardently devoted to scientific contrivances and experiments, and to have been in the habit of converting all

sorts of articles into auxiliaries in his favourite pursuits, it is not probable that the various strange preparations which filled the shelves and boxes of his landlord's shop would escape his curious examination. Although Newton's glory chiefly depends upon his discoveries in abstract and mechanical science, some of his speculations, and especially some of his writings on the subjects of light and colour, show that the internal constitution of matter and its chemical properties had also much occupied his thoughts. Thus, too, in other departments, genius has found its sufficient materials and instruments in the humblest and most common articles, and the simplest contrivances. Ferguson observed the places of the stars by means of a thread with a few beads strung on it, and Tycho Brahe did the same thing with a pair of compasses. The self-taught American philosopher, Rittenhouse, being, when a young man, employed as an agricultural labourer, used to draw geometrical diagrams on his plough, and study them as he turned up the furrow. Pascal, when a mere boy, made himself master of many of the elementary propositions of geometry without the assistance of any master, by tracing the figures on the floor of his room with a bit of coal. This, or a stick burned at the end, has often been the young painter's first pencil, while the smoothest and whitest wall he could find supplied the place of a canvass. Such, for example, were the commencing essays of the early Tuscan artist, Andrea del Castagno, who employed his leisure in this way when he was a little boy tending cattle, till his performances at last attracted the notice of one of the Medici family, who placed him under a proper master. The famous Salvator Rosa first displayed his genius for design in the same manner. To these instances may be added that of the late English musical composer Mr. John Davy, who is said, when only six years old, to have begun the study and practice of his art by imitating the chimes of a

neighbouring church with eight horse-shoes, which he suspended by strings from the ceiling of a room in such a manner as to form an octave.*

But to return to our young English chemical student. For a time Davy pursued his experimental investigations, without teacher or guide, in the manner that has been described, and aided only by the scantiest and rudest apparatus. When still a lad, however, he was fortunate in making the acquaintance of Mr. Gregory Watt, the son of the celebrated James Watt. This gentleman, having come to reside at Penzance for the recovery of his health, lodged with Mrs. Davy, and soon discovered the talent of her son. The scientific knowledge of Mr. Watt gave an accurate direction to the studies of the young chemist, and excited him to a systematic perseverance in his favourite pursuit. Chance attracted to him the notice of Mr. Davies Giddy (afterwards Mr. Gilbert, and President of the Royal Society), which the discovery of his merits soon improved into patronage and friendship. The boy, we are told, was leaning on the gate of his father's house when Mr. Gilbert passed accompanied by some friends, one of whom remarked that there was young Davy, who was so much attached to chemistry. The mention of chemistry immediately fixed Mr. Gilbert's attention; he entered into conversation with the young man, and, speedily becoming convinced of his extraordinary talents and acquirements, offered him the use of his library, and whatever other assistance

* Many of our readers may probably be acquainted, either in the original or in the English translation, with the work of the German writer, Campe, entitled *The New Robinson*, which, in an account of the various expedients supposed to be resorted to by a young seaman cast ashore on an uninhabited island, and obliged to provide for himself sustenance and shelter by the aid merely of such implements as he could fashion by his own ingenuity, presents a very interesting picture of the manner in which many of the ordinary processes of mechanical art might be performed without the ordinary tools.

he might require for the pursuit of his studies. Mr. Gilbert and Mr. Watt soon after this introduced Davy to the celebrated Dr. Beddoes, who had just established at Bristol what he called his Pneumatic Institution, for investigating the medical properties of the different gases. Davy, who was now in his nineteenth year, had for some time been thinking of proceeding to Edinburgh, in order to pursue a regular course of medical education; but, Dr. Beddoes, who had been greatly struck by different proofs he had given of his talents, and especially by an essay in which he propounded an original theory of light and heat, having offered him the superintendence of his new institution, he at once closed with that proposal.

The young philosopher was now fairly entered on his proper path, and from this date we may consider him as having fairly escaped from the disadvantages of his early lot. But it was while yet poor and unknown that he had made those acquirements which both obtained for him the notice of his present patrons, and fitted him for the situation in which they placed him. His having attracted the attention of Mr. Gilbert, as he stood at his father's gate, may be called a fortunate incident; but it was one that never would have happened had it not been for the proficiency he had already made in science by his own endeavours. Chance may be said to have offered this opportunity of emerging from obscurity; but, had he not previously laboured in the cultivation of his mind as he had done, it would to him have been no opportunity at all.

The experiments conducted by Davy, and under his direction, at the Bristol Institution, were soon rewarded by important results; and of these, Davy, when he had just completed his twenty-first year, published an account, under the title of 'Researches, Chemical and Philosophical, chiefly concerning Nitrous Oxide, and its Respiration.' In this publication the singular intoxi-

cating effects produced by the breathing of nitrous oxide were first announced; and it excited a considerable sensation in the scientific world, and at once made Davy generally known as a most ingenious and philosophic experimentalist. He was, in consequence, soon after its appearance, invited to fill the chemical chair of the Royal Institution, then newly established. When he commenced his lectures here, he was scarcely twenty-two years of age; but never was success in such an attempt more decided and brilliant. He soon saw his lecture-rooms crowded, day after day, by all that was most distinguished in the rank and intellect of the metropolis; and his striking and beautiful elucidations of every subject that came under his review riveted, often even to breathlessness, the attention of his splendid auditory. The year after his appointment to this situation he was elected also Professor of Chemistry to the Board of Agriculture; and he greatly distinguished himself by the lectures which, for ten successive sessions, he delivered in this character. They were published in 1813, at the request of the Board.* In 1803, when only in his twenty-fifth year, Davy was elected a Fellow of the Royal Society, and his contributions to the Transactions, from this time till his death, were frequent, and of the highest value. In 1806 he was chosen to deliver the Bakerian Lecture before the Society; and he performed the same task for several successive years. Many of his most brilliant discoveries were announced in these discourses. In 1812 he received the honour of knighthood from the Prince Regent, being the first person on whom his Royal Highness conferred that dignity: and two days after he married a lady who brought him a considerable fortune. Next year he was elected a corresponding member of the French Institute. He was

* A new edition of these Lectures, with copious annotations, bringing them up to the knowledge of the present day, was some years ago given to the world by Professor Shier of Aberdeen.

created a baronet in 1818. In 1820 he was chosen a foreign associate of the Royal Academy of Sciences at Paris, on the death of the illustrious Watt. He had been for some time secretary to the Royal Society; and in 1820, on the death of Sir Joseph Banks, he was, by a unanimous vote, raised to the Presidency of that learned body—an office which he held till he was obliged to retire, from ill health, in 1827, when his friend and first patron, Mr. Gilbert, was chosen to succeed him. Little, we may suppose, did either of the two anticipate, when they first met, thirty years before, at the gate of Davy's father's house, that they would thus stand successively, and in this order, at the head of the most distinguished scientific association in England.

It is impossible for us in this place to attempt anything more than the most general sketch of Sir Humphry Davy's numerous and most important discoveries in chemical science. Even his earliest publication, the title of which we have already transcribed, was regarded as, for the first time, introducing light and order into an interesting department of the science,—the theory of the various combinations of oxygen and nitrogen, the two gases which, mixed together in certain proportions, form our common atmospheric air, but in other proportions produce compounds of an altogether dissimilar character. The first memoir by Davy which was read before the Royal Society was presented by him in 1801, before he was a member. It announced a new theory, which is now generally received, of the galvanic influence, or the extraordinary effect produced by two metals in contact with each other, when applied to the muscle even of a dead animal, which the Italian professor, Galvani, had some years before accidentally discovered. It was supposed both by Galvani and his countryman Volta, who also distinguished himself in the investigation of this curious subject, that the effect in question was an electrical phenomenon—whence gal-

vanism used to be called animal electricity; but Davy showed, by many ingenious experiments, that, in order to produce it, the metals in fact underwent certain chemical changes. Indeed, he proved that the effect followed when only one metal was employed, provided the requisite chemical change was by any means brought about on it, as, for example, by the interposition between two plates of it of a fluid calculated to act upon its surface in a certain manner. In his Bakerian Lecture for 1806, he carried the examination of this subject to a much greater length, and astonished the scientific world by the announcement of a multitude of the most extraordinary results, from the application of the galvanic energy to the composition and decomposition of various chemical substances. From these experiments he arrived at the conclusion, that the power called chemical affinity was, in truth, identical with that of electricity. Hence the creation of a new science, now commonly known by the name of Electro-Chemistry, being that which regards what is held to be the action of electricity in the production of chemical changes. The discourse in which these discoveries were unfolded was crowned by the French Institute with their first prize, by a decision which reflects immortal honour upon that illustrious body; who thus forgot not only all feelings of national jealousy, but even the peculiar and extraordinary hostility produced by the war then raging between the two countries, in their admiration of genius and their zeal for the interests of philosophy.

But the results which this great chemist had already obtained only formed, in his hands, the source of new discoveries. In the interesting and extraordinary nature of its announcements, the Bakerian Lecture of 1807 was as splendid a production as that of the former year. There are certain substances, as the reader is aware, known in chemistry by the name of alkalis, of which potash and soda are the principal. These substances

chemists had hitherto in vain exhausted their ingenuity, and the resources of their art, in endeavouring to decompose. The only substance possessing alkaline properties the composition of which had been ascertained was ammonia, which is a gas, and is therefore called *volatile* alkali; and, this having been found to be a compound of certain proportions of hydrogen and nitrogen, an opinion generally prevailed that hydrogen would be found to be also a chief ingredient of the *fixed* alkalis. Davy determined, if possible, to ascertain this point, and engaged in the investigation with great hopes of success, from the surpassing powers of decomposition which he had found to belong to his new agent, the galvanic influence. The manner in which he pursued this object is one of the most beautiful specimens of scientific investigation on record. One of the most important of the laws of galvanic decomposition, which he had previously discovered, was, that, when any substance was subjected to this species of action, its oxygen (an ingredient which nearly all substances contain) was developed at what is called the positive end or pole of the current of electricity, while, whenever any hydrogen or inflammable matter was present, it uniformly appeared at the opposite or negative pole. Proceeding upon this principle, therefore, Davy set to work with a fixed alkali; and at first submitted it dissolved in water to the galvanic action. The result, however, was, that the water alone was decomposed, nothing being disengaged by the experiment but oxygen and hydrogen, the ingredients of that fluid, which passed off as usual, the former at the positive, the latter at the negative pole. In his subsequent experiments, therefore, Davy proceeded without water, employing potash in a state of fusion; and, having guarded the process from every other disturbing cause that presented itself by a variety of ingenious arrangements, he had at last the satisfaction of seeing the oxygen gas developed, as before, at the positively electrified

surface of the alkali, while at the same time, on the other side, small globules of matter were disengaged, having all the appearances of a metal. The long-agitated question was now determined; the base of the fixed alkalis was clearly metallic. To ascertain the qualities of the metallic residue which he had thus obtained from the potash was Davy's next object. From its great attraction for oxygen, it almost immediately, when exposed to the atmosphere, became an alkali again, by uniting with that ingredient; and at first it seemed on this account hardly possible to obtain a sufficient quantity of it for examination. But at last Davy thought of pouring over it a thin coating of the mineral fluid called naphtha, which both preserved it from communication with the air, and, being transparent, allowed it to be examined.

We have thus rapidly sketched the course of these brilliant and successful experiments, because they form a most interesting and instructive exemplification of the manner in which knowledge is pursued, and the secrets of Nature extorted from her, by well-directed interrogation. The business of philosophic experiment, it may be well to observe, is not a mere random expenditure of tests and applications. The true disciple of the inductive philosophy, on the contrary, has always in his contemplation, while conducting his experiments, an idea or end which he aims at realising, and which, in fact, directs him to every experiment to which he resorts. Thus, in the present instance, the idea in Davy's mind was, that the alkali was compounded of two ingredients which had severally an attraction for the two opposite poles of the electric current. This idea he never lost sight of throughout the whole course of his experiments, though he repeatedly shifted his ground in regard to the contrivances by which he sought its proof and manifestation. To proceed in any other way would not be to philosophise, but merely, as it were, to dip the hand into the bag of chance in quest of a discovery, as men draw

prizes at a lottery. It is true that, until the experiment has confirmed or refuted his expectations, this guiding idea upon which the experimenter proceeds must be regarded merely as a conjecture. But such a conjecture or hypothesis he must have in his mind, or he is in no condition to set about the inquisition of nature. What progress would the conductor of a trial in a court of justice be likely to make, in questioning a witness, without some previous notion of the truth which the evidence was likely to establish? He might waste the whole day in putting questions and receiving answers, and at last have ascertained nothing. Just as unprofitably would the interrogator of nature spend his time, if he had no directing anticipation in every case according to which to order his experiments. Accident might, it is possible, throw a discovery in his way; but his own occupation would be evidently as idle and as little that of a philosopher as the rattling of a dice-box. *Whenever, indeed, a discovery is made without being anticipated, we say that it has been made by chance.* On the other hand, the history of all discoveries that have been arrived at by what can with any propriety be called philosophical investigation and induction attests that necessity which has been asserted of the experimenter proceeding in the institution and management of his experiments upon a previous idea of the truth to be evolved. This previous idea is what is properly called an *hypothesis*, which means something *placed under* as a foundation or platform on which to institute and carry on the process of investigation. A *theory* is a completed view of an harmonious system of truths, evolved and proved by calculation or induction. As the latter is the necessary completion of every philosophical inquiry, so the former is its equally indispensable beginning. It is the aim in the mind of the philosopher, without which he cannot philosophise. It makes, in short, the main difference between the experiments of the philosopher in his laboratory, and

those of the child among its playthings. Of course, however, every hypothesis must give way before an experiment the result of which cannot be reconciled with it. Newton, in proceeding to investigate the system of the heavens, set out on the hypothesis that the same power of gravitation which made a stone fall to the ground would be found to retain the moon and the planets in their orbits around the earth and the sun. The result of his first calculation was unfavourable to this supposition, and he at once abandoned it. We have here an example both of the use of an hypothesis, and of the proper limits of reliance on it. The grand discovery which eventually resulted from Newton's investigations affords us, again, an illustration of the manner in which an hypothesis serves to lead to, and originate a theory.*

The metal which Sir Humphry Davy obtained from potash he called *Potassium*; and from soda he also, by a similar process, obtained another which he called *Sodium*. Both these new metals he found to possess several curious properties, which, however, we cannot stop here to enumerate. He afterwards decomposed also the different earths, and showed them to be all, as well as the alkalis, compounds of oxygen with a metallic base. But these important discoveries, which may be said to have revolutionised the science of chemistry, were not the only results which he obtained from his galvanic and electrical experiments. The interesting subject of the connexion between electricity and magnetism received considerable elucidation from his researches. For an account of his contributions to this branch of science, we must refer to the able memoir we have already mentioned, or to his papers on the magnetic phenomena produced by electricity in the Philosophical Transactions.†

* See this subject admirably treated in the Preliminary Discourse to the Encyclopædia Metropolitana (by Coleridge).

† Philosophical Transactions for 1819.

Meanwhile his attention had been attracted to another subject of the greatest practical importance—the possibility of preventing the destructive explosions in coal-mines occasioned by the fire-damp, or inflammable gas, which is found in many parts of them. By a series of experiments Davy found that this dangerous gas, which was known to be nothing more than the hydrogen of the chemists, had its explosive tendencies very much restrained by being mixed with a small quantity of carbonic acid and nitrogen (the ingredient which, along with oxygen, forms atmospheric air); and that, moreover, if it did explode when so mixed, the explosion would not pass through apertures less than one-seventh of an inch in diameter. Proceeding, therefore, upon these ascertained facts, he contrived his celebrated *Safety Lamp*. It consists of a small light, fixed in a cylindrical vessel, which is everywhere air-tight, except in the bottom, which is formed of fine wire gauze; and in the upper part, where there is a chimney for carrying off the foul air. The air admitted through the gauze suffices to keep up the flame; which, in its combustion, produces enough of carbonic acid and nitrogen to prevent the fire-damp, when inflamed within the cylinder, from communicating the explosion to what is without. The heretofore destructive element, thus caught and detained, is therefore not only rendered harmless, but actually itself helps to furnish the miner with light, the whole of the interior of the cylinder being filled with a steady green flame, arising from the combustion of the hydrogen, which has been admitted to contact with the heat, but cannot carry back the inflammation it has received to the general volume without. Armed with this admirable protection, therefore, the miner advances without risk, and with sufficient light to enable him to work, into recesses which formerly he could not have dared to enter. The safety lamp has already been the means of saving many lives,

and has enabled extensive mines, or portions of mines, to be wrought, which, but for its assistance, must have remained unproductive.* The coal-owners of the northern districts invited Sir Humphry, in 1817, to a public dinner, and presented him with a service of plate of the value of 2000*l.*, in testimony of what they felt to be the merit of this invention.

We will mention only another of this eminent individual's ingenious practical applications of those scientific truths with which he enriched the philosophy of his age. About the year 1823, the attention of the Commissioners of the Navy was so strongly excited to the fact of the rapid decay of the copper sheathings of ships when exposed to the action of the salt-water, that they applied to the Royal Society to take the subject into consideration, and endeavour to devise a remedy for the evil. On this occasion, Davy again had recourse to those principles of electro-chemistry, of which he had himself been the discoverer, and by the application of which he had already obtained so many brilliant results. One of the laws of electrical agency which he considered himself to have ascertained, was that two substances can only combine by what is called chemical affinity or attraction when they are in opposite electrical states,—that is to say, when the one is positively, and the other negatively, electrified. The copper and the water, therefore, he concluded, were naturally in these circumstances; and all that would be required, consequently, to prevent the action of the one upon the other, would be to change the electrical condition of that one of them, namely the copper, which it was possible to submit to the necessary treatment. He thought of various ways of effecting this object; but, at last, he determined to try the effect of merely placing a quantity of zinc or iron in contact with the copper; the

* See Report of Committee of the House of Commons on the Coal Trade (1829).

former metals being more positive than the latter, and therefore fitted by induction to repel a portion of its electricity, and so to render it negative like the water.* The result surpassed his expectations. So powerfully did the one metal act in reversing the electrical state of the other, that a bit of zinc or iron no larger than a pea was found sufficient to protect from corrosion forty or fifty square inches of copper. Nothing, therefore, could be more perfect than the success of this contrivance for the particular purpose it was intended to serve. But, unfortunately, it has been found by experience, that, although Davy's method completely answers for preventing the wasting of the copper, the sea-weeds and marine insects accumulate in such quantities upon the bottoms of ships so protected, that they become, after a short time, scarcely navigable. For the present, therefore, the use of the zinc and iron is of necessity abandoned. It is by no means improbable, however, that some expedient may be contrived for counteracting this consequence of the application of Davy's invention—in which case it will be entitled to rank as one of the most valuable discoveries ever made.

We have thus, guided chiefly by the Memoir of which mention has been made above, pursued the principal triumphs of Sir Humphry's splendid career, and described what he achieved, although cursorily and briefly, in such a manner, we trust, as to put even the unscientific reader in possession of a tolerably just view of the great discoveries on which his fame rests. In 1827, as we have already mentioned, his health had so broken down that he found it necessary to resign the presidency of the Royal Society. Immediately after this he proceeded to the Continent. During his absence from England, he still continued to prosecute his chemical researches, the results of which he communicated in several papers to

* See vol. i. p. 256, 257.

the Royal Society. He also, notwithstanding his increasing weakness and sufferings, employed his leisure in literary composition on other subjects, an evidence of which appeared in his 'Salmonia,' a treatise on fly-fishing, containing many accurate and striking descriptions of natural phenomena, and breathing throughout the most amiable and contented spirit, which he published in 1828. His active mind, indeed, continued, it would seem, to exert itself to the last almost with as unwearied ardour as ever. Beside the volume we have just mentioned, another work, entitled 'The Last Days of a Philosopher,' which he also wrote during this period, has been given to the world since his death. He died at Geneva on the 28th of May, 1829. He had only arrived in that city the day before; and, having been attacked by apoplexy after he had gone to bed, expired at an early hour in the morning.

No better evidence can be desired than we have in the history of Davy, that a long life is not necessary to enable an individual to make extraordinary advances in any intellectual pursuit to which he will devote himself with all his heart and strength. This eminent person was, indeed, early in the arena where he won his distinction; and the fact, as we have already remarked, is a proof how diligently he must have exercised his mental faculties during the few years that elapsed between his boyhood and his first appearance before the public, although, during this time, he had scarcely any one to guide his studies, or even to cheer him onward. Yet, notwithstanding that he had taken his place, as we have seen, among the known chemists of the age almost before he was twenty-one, the whole of his brilliant career in that character, embracing so many experiments, so many literary productions, and so many splendid and valuable discoveries, extended only over a space of not quite thirty years. He had not completed his fifty-first year when he died. Nor was Davy merely a man of science.

His general acquirements were diversified and extensive. He was familiar with the principal continental languages, and wrote his own with an eloquence not usually found in scientific works. All his writings, indeed, show the scholar and the lover of elegant literature, as well as the ingenious and accomplished philosopher. It not unfrequently happens that able men who have been their own instructors, and have chosen for themselves some one field of exertion in which the world acknowledges, and they themselves feel, their eminence, both disregard and despise all other sorts of knowledge and acquirement. This is pedantry in its most vulgar and offensive form; for it is not merely ignorant, but intolerant. It speaks highly in favour of the right constitution and the native power of Davy's understanding, that, educated as he was, he escaped every taint of this species of illiberality; and that, while, like almost all those who have greatly distinguished themselves in the world of intellect, he selected and persevered in his one favourite path, he nevertheless revered wisdom and genius in all their manifestations.*

* The Life of Sir Humphry Davy has been twice written in full detail since the present work was first published; by Dr. J. A. Paris, in 2 vols. 8vo. 1830, and by his brother Dr. John Davy, whose narrative makes the first volume of Sir Humphry's collected works, 9 vols. 8vo. 1839-40.

CHAPTER VII.

MR. FARADAY; M. LAURENT.

For his years Sir Humphry Davy might still have been among us, an old man, but younger than several illustrious contemporaries—than Mr. Savage Landor, whose "prompt eloquence,...in prose or numerous verse," still flows as readily as ever, both from lip and pen, at the age of eighty-two—than Ludwig Tieck, who survives at that of eighty-four, the venerable father of living poets, novelists, and æsthetic critics—than Lord Lyndhurst, who, at that of eighty-five, still keeps his place in the front rank of parliamentary debaters, with his wonderful clear-headedness and power of mental grasp unimpaired—than Alexander Von Humboldt, one of the remarkable products of the memorable year sixty-nine, which gave birth also to Napoleon and Wellington and Mehemet Ali and Castlereagh, still the master of his universal knowledge, and with head and heart both strong, at eighty-eight—than Rogers, who passed away only the other day at ninety-four, and continued to enjoy life almost to the last, having already surmounted his fortieth year at the date of the execution of Louis the Sixteenth, and perfectly remembering the death of Samuel Johnson, which took place when he was a young man of two and twenty, and having actually made his appearance in print in the same year, and probably some months earlier in the year, which witnessed the first publication of the poetry of Burns (who was his senior by only three years, having been born in the same year with the younger Pitt). If Davy had been alive now, he would have been some months younger than Lord Brougham, who still fills as large a space as any other

living man in the public eye,—enjoys, in fact, more than any other now remaining a European celebrity, and that both in politics and in letters,—and whom we all hope to retain for yet many a day. It is only a few months since we had a new book from Davy's younger brother, his able biographer and the editor of his collected works. But the living light of the great chemist's genius may be said to be still with us in one who took from him his first inspiration, and whom a more advanced state of science, and perhaps also a still higher originality and inventive power, and a finer and subtler intellect, have carried to some deeper and more comprehensive philosophic views than Davy of himself would have reached. FARADAY has himself related how it was that he first became connected with his distinguished predecessor in the following letter to the late Dr. Paris, which is given in that gentleman's 'Life of Davy:'—

"My dear sir, you asked me to give you an account of my first introduction to Sir H. Davy, which I am very happy to do, as I think the circumstance will bear testimony to his goodness of heart. When I was a bookseller's apprentice, I was very fond of experiment, and very averse to trade. It happened that a gentleman, a member of the Royal Institution, took me to hear some of Sir H. Davy's last lectures in Albemarle Street. I took notes, and afterwards wrote them out more fairly in a quarto volume. My desire to escape from trade, which I thought vicious and selfish, and to enter into the service of science, which I imagined made its pursuers amiable and liberal, induced me at last to take the bold and simple step of writing to Sir H. Davy, expressing my wishes, and a hope, that, if an opportunity came in his way, he would favour my views; at the same time I sent the notes I had taken at his lectures. The answer, which makes all the point of my communication, I send you in the original, requesting you to take great care of it, and to let me have it back, for you may

imagine how much I value it. You will observe that this took place at the end of the year 1812, and early in 1813 he requested to see me, and told me of the situation of Assistant in the Laboratory of the Royal Institution, then just vacant. At the same time that he thus gratified my desires as to scientific employment, he still advised me not to give up the prospects I had before me, telling me that science was a harsh mistress; and, in a pecuniary point of view, but poorly rewarding those who devoted themselves to her service. He smiled at my notion of the superior moral feeling of philosophic men, and said he would leave me to the experience of a few years to set me right on the matter. Finally, through his good efforts, I went to the Royal Institution, early in March 1813, as Assistant in the Laboratory; and in October of the same year went with him abroad, as his assistant in experiments and in writing. I returned with him in April 1815, resumed my station in the Royal Institution, and have, as you know, ever since remained there." Sir Humphry's note was as follows:—"December 24, 1812. Sir, I am far from displeased with the proof you have given me of your confidence, and which displays great zeal, power of memory, and attention. I am obliged to go out of town, and shall not be settled in town till the end of January: I will then see you at any time you wish. It would gratify me to be of any service to you. I wish it may be in my power. I am, Sir, your obedient, humble servant, H. DAVY." All this is as illustrative of Davy as of Faraday, and equally honourable to both. It links the history of the one to that of the other. Faraday is stated to have been born in 1794; he was therefore eighteen when he thus made acquaintance with Davy, and obtained through him his first appointment at the Royal Institution.* His

* It must therefore, apparently, be through a miscalculation or a misprint that he is stated in the *Men of the Time* to have worked at his trade of a bookbinder "until he was twenty-two years of age."

birthplace, we believe, was Kirkby Steven, in Westmoreland; and, of humble parentage, he is understood to have had but little school education. But with such minds a little goes a long way; the seed, that might have fallen upon a rock, and withered away, because it lacked moisture, or among thorns that would have sprung up and choked it, falling on good ground bears fruit an hundredfold. Faraday's life, we may be sure, has been throughout one of self-education; he would neglect no opportunities of improvement, would be dead to no good influence he ever came in the way of. Even the binding of books was a connection with literature which would not go for nothing. Here too is a sort of *composition*, or putting together, although the term has not happened to be technically so applied, as it has been to the other mechanical operation of setting up the types. Decorative bookbinding almost rises to the character of a subordinate department of the artistic; a beautifully bound book is a delight to look at. They talk of *style* being the dress of thought; the true *dress* of thought is what is give it by the bookbinder. And his art, even when it is purely mechanical, is always ingenious; so much so that it has often been assiduously practised even as an amusement. While Faraday worked at it, we are told, his inventive talent had displayed itself in the construction of an electrical machine and other scientific contrivances; and it was the sight of these, to which his master, one Riebau, of Blandford Street, London, one day called the attention of a customer, Mr. Dance, of Manchester Street (such names ought to be remembered), that induced the latter, who was one of the old members of the Royal Institution, to take the boy with him to hear the last four lectures that Sir Humphry Davy delivered as professor.* Faraday's subsequent career, as all know, has been brilliant in the highest degree. He has, as he observes in his letter

* 'Men of the Time,' p. 271.

to Dr. Paris, been faithful, ever since it first opened its doors to him forty-five years ago, to the Royal Institution, where he has since the retirement of Mr. Brande in 1834 filled the chair of Davy, and where, by the extraordinary faculty of easy and luminous exposition with which he is gifted, and by the neatness and never-failing dexterity of his experimental manipulation, he has made the philosophy of matter, in many of its highest as well as of its simplest manifestations, interesting alike to all classes, to the learned and unlearned, to the old and young, to men and women. Meanwhile his splendid discoveries in electrical chemistry and the contiguous regions of physical science, and the singular combination, in all his views and speculations and methods of procedure, of the most patient vigilance in examination, and the most self-denying caution in forming his conclusions, with the highest originality and boldness, have placed him by universal recognition in the first rank of the modern cultivators of physical science. But all this renown has changed nothing of the noble and beautiful nature of the man; it is impossible even for a stranger, seeing him only in public, not to be attracted and charmed by the unsophisticated simplicity and sunny brightness of his whole demeanour; and he is as much the object of affectionate regard with all who know him in private life as he is the pride of his country and the admiration of the whole scientific world.

With his genius Faraday combines a remarkable share of practical talent; his practical talent may even be said to make part of his genius. To this he has no doubt been much indebted for his success in life. Not unfrequently, however, we have among the students of the severer sciences, as well as among the cultivators of poetry and the imaginative arts, genius of a very high order, and also the most disinterested devotion to their intellectual pursuit, and great skill in all the operations and methods of procedure it demands, accompanied with

apparently so little of ordinary worldly ability that we are apt to think one of the elements of their genius must be their deficiency in common sense. But this can hardly be ever the true view of the matter. It is not usually that the capacity for attaining what is called success in life is wanting in the man of genius, but rather that he has a much stronger desire for another kind of success. The most powerful and most harmoniously adjusted minds, it is true, with the same preference for the higher object, find no difficulty in giving the requisite attention also to the other. Nevertheless, even where the intellectual devotee fails in doing this, his appreciation of what is greatest and noblest, bringing inconvenience only upon himself, is a beautiful thing, and only commands our sympathy and admiration all the more for what it costs him. It is still, in its one-sidedness, as superior to the opposite more common one-sidedness, as superior not only in attractiveness but in true wisdom, as poetry is to prose.

A few years ago one of the most remarkable among the cultivators of chemical science in France ended a life of continual contest with circumstances by a premature death. As the propounder of what are known as the Nucleus Theory and the Theory of Substitution, AUGUSTE LAURENT ranks among the few discoverers to whom we owe the knowledge of certain new general principles of the constitution of the universe, or what may be called laws of nature. He was born in the department of the Haute Marne in 1807; and, the son of a wine-merchant, was originally intended to be brought up to his father's business. They could not get him, however, we are told, to learn book-keeping. He appears, in fact, to have had a decided preference for other occupations that afforded more scope and exercise for his ingenuity and inventive genius than that respectable art. For some time his head was filled, as so many others, young and old, have been, with the

dream of the perpetual motion. Then he took to constructing small mills, in some way of his own. At last, when he was nineteen, his father was prevailed upon to allow him to follow his inclination, and he was sent to Paris, and entered at the *Ecole des Mines*.

Here he remained till 1829, when he left the institution with the diploma of *Ingénieur des Mines*, and set out on a course of scientific exploration through Austria, Poland, Saxony, and the Rhine Provinces, making inspection everywhere both of mines and factories, and treasuring up what he observed in copious notes.

But the end was that he resolved to give himself up exclusively to chemistry, which had powerfully attracted him from his first acquaintance with it. By this determination he changed his profession, or his professional destination, again, but it was for the last time; he had now at length found his proper field, the science for which he was born and made.

Even thus, however, he had attained for himself no secure social position or resting-place; nor was that, apparently, what he much cared for. All that he wanted was simply so much of leisure as to enable him to carry on his chemical investigations. Give him that, with merely enough to keep him alive, and he was satisfied. No success in money-making, on the other hand, would have been to him other than a gilded bondage which did not leave him the independent command of the larger portion of his time. It is true that there was something of weakness and morbid feeling in this, and much miscalculation and mismanagement in his way of proceeding; with a little more prudence and self-control he might have been much more successful even in achieving the independence which was what he most cared and longed for; the only such independence possible in this world is what is based on the possession of money or other accumulated capital, and Laurent's shortest and most direct course to his desired haven of

leisure would have been through steady perseverance for a few years in the making and saving of money. The only hard work to which he could ever give himself for any length of time was such as had his whole heart. But, on the other hand, if he had no turn or talent for making money, he appears to have been as little given to the wasting of it; whatever he earned lasted him longer than it would have done most people.

The first appointment which he obtained was that of chemist at the celebrated porcelain manufactory of Sèvres. But in no long time he resigned it, and, betaking himself to a garret in Paris, there set up his own laboratory, proposing to make a livelihood by receiving pupils. And he had no difficulty in procuring as many as he wanted; the value of his instructions was appreciated, and his enthusiasm also probably proved contagious. But as soon as he had in this way accumulated a little money, he dismissed his classes and shut himself up alone among his crucibles and alembics. Then, when his money was all spent, he again set to earn more in the same way; and, when he had done so, secluded himself as before. It was in the midst of all this, in November, 1837, that, to obtain from the University his degree of Doctor of Science (Docteur des Sciences), he presented his thesis on the Theory of Organic Combinations, in which he announced some of the most remarkable of his new views, and which he had to defend in a contest of two hours with Dumas and other professors.

We next find him employed for two years as superintendent of the chemical operations in the establishment of a Parisian perfumer. This he left to be chemist to a porcelain manufactory in Luxembourg. Here finding, on settling accounts with his employer after eighteen months, during which he had drawn no salary except only a five franc piece now and then, that there was about 400*l*. sterling due to him, he thought himself rich

enough to marry. And soon after he accepted a Professorship in the College of Bordeaux. But his late first experience of money-making, with the pressure of the new demands upon him in his altered condition, had now made him think that a larger income might be convenient; and he entered into partnership with another capitalist, no doubt much richer than himself, in a scheme for the manufacturing of sulphate of magnesia and sulphate of copper. It proved a failure, and, after a world of trouble, he was glad to get fairly disentangled from it at the cost of his ten thousand francs, all that he possessed in the world. "Take my all," he said, after they had wearied him out, "and let me off." He now, we are told, resolved to devote himself exclusively to the theoretical part of science, convinced that he had not a practical turn of mind.

The next thing we hear of him is his resignation of his professorship. No other reason is assigned for his taking this step except that he found himself out of his element at Bordeaux, which he conceived to be essentially a literary town, and as such an uncongenial residence for a cultivator of the physical sciences. The true way of putting the case, perhaps, would rather be, that he felt his provincial life to be a sort of exile, or life underground, and yearned to get back to Paris, the centre of intelligence, as his proper home and working-place. Thither, accordingly, he repaired, in the beginning of 1846, with his wife and son, and a matter of 2,000 francs, being half his salary, with which they had paid him off, and established himself in a fourth floor of the Rue de l'Université, proposing to make an income by resuming his old plan of taking pupils. It was the same passion, though operating in an opposite direction, with that which draws the wild man back to his woods, and makes the heart of the Celtic mountaineer bound high when he feels his step once more upon the heather. There is some one kind of life that is alone

truly life to each of us, in which alone we seem to ourselves to have the full light of day about us.

In an economical sense Laurent's transference of himself to Paris cannot be said to have turned out ill. He probably continued to make at least as good an income as he had had at Bordeaux; and he was certainly better placed for the prosecution of his peculiar studies and investigations, and also more in the way of public recognition and patronage. The laboratory of the Ecole Normale, we are told, was at once placed at his disposal by its director, M. Balard; and he was thus enabled to complete some important researches,—although, it is intimated, in his modest and delicate feeling with regard to what was not his own, he confined himself to the use of such materials and apparatus as were least expensive.

Nor had he long to wait for a public appointment. In May, 1848, he was made Assayer to the Mint. He had thus again secured a fixed position. He now gave himself up entirely to the duties of his office and his chemical investigations, passing all his spare time at the Hôtel de la Monnaie, unfortunately in a room which is described as a kind of cellar, and both dark and damp. This soon began to tell upon his health.

We have collected the above facts from a somewhat more detailed account contained in the address of Colonel Philip Yorke, the President, delivered at the Anniversary Meeting of the Chemical Society of London on the 30th of March, 1854, and published in the Quarterly Journal of the Society for July, of the same year. Two years, Colonel Yorke states, passed in the circumstances that have been described. "Engaged," the memoir proceeds, "on nearly all subjects of organic chemistry, and in analysing the most complicated mixtures, Laurent yet found the means of extending his hospitality to one or two chemists who had no laboratories, and furnishing them with the means of working. His laboratory was the rendezvous of a great number of

scientific men; there was no lack of news there; and Laurent had every day some new result to announce, or some new idea to develope. Raw materials were also sent to him from all sides for examination. Among other matters of this kind, mention is made of a certain amorphous precipitate, which no one was able to recognise, prepared by a chemist who refused to state the means by which he had obtained it, and moreover shrank from the difficulty of obtaining anything definite from it. Laurent was totally ignorant of its origin, but that made little difference to him. He employed his usual re-agents, and in a few hours succeeded in extracting from it a beautiful yellow crystalline substance consisting of a nitro-compound of the phenyl series. The amorphous precipitate was a residue obtained by treating coal-tar naphtha with nitric acid.

"Laurent possessed a degree of analytical tact never before known: his researches on naphthalia, indigo, bitter almond oil, &c., remain as monuments of a genius for investigation which, unfortunately, will not soon be equalled. The immense number of new compounds which he discovered,—for which, indeed, he was obliged to create a new nomenclature—were prepared with the aid of a small number of re-agents; and the merit of these researches is farther increased by the consideration that they were not merely the inspiration of an active mind, but were conceived under the influence of a fundamental idea of which the Substitution Theory is one of the consequences. With chlorine, nitric acid, ammonia, sulphuric acid, and potash, Laurent produced his combinations and decompositions; water, alcohol, ether, and the goniometer served him for the recognition and isolation of his products. He was the first to employ the goniometer as a re-agent, and no one knew better how to manage it. He had learned the use of it while pursuing his studies at the *Ecole des Mines*, and had early recognised its utility in purely chemical investiga-

tions. At an early period, also, he had laid down the fundamental proposition, that Form and Arrangement may be as important as composition,—a proposition round which all his researches may be said to gravitate. The consequences which followed from it are well known: their names are, Theory of Nuclei, Theory of Substitution, Divisibility of Atoms, Paramorphism, Hemimorphism, Isotheromorphism, Multiple Equivalents, Law of Even Numbers, &c.

"In the midst of these brilliant discoveries, Laurent devoted himself to his work with daily increasing ardour, each laboratory session yielding its contingent of new results. As if aware of the premature end which awaited him, he used all his efforts to produce and to consolidate. Happily for science, but unfortunately for his family, this preoccupation of his mind bore sway over every other consideration, and made him totally negligent of the material side of life; as a pioneer of the future, he belonged especially to humanity, and devoted himself entirely to his mission as one who thoroughly appreciated it."

At length, however, an affection of the chest, under which he had been for some time suffering, became so much worse that his physicians insisted upon his withdrawing himself from his laboratory. He reluctantly obeyed; he consented to forego the more exciting work of actual analysis and experiment; but work of some kind was almost a necessity for his ardent nature and busy brain. Balard, Biot, and other friends suggested that he should weave the vast number of new facts that he had registered, and the various original views which he had from time to time thrown out, into a systematic treatise. He eagerly caught at the idea; and in a comparatively short time he produced what Colonel Yorke characterises as a colossal work. "This work," the narrative goes on, "supplied him with constant occupation; as long as he was able to hold a pen, he worked at

it with a degree of vigour and activity which excited the admiration of those who were acquainted with his situation. Laurent, indeed, had never deceived himself about the fate which awaited him; it was not the mere prospect of death which alarmed him, but he was about to leave a wife and two children in a state of destitution; he had had no time to amass wealth, nor had he rendered a sufficient amount of administrative services to hope for a pension for his widow. These harassing thoughts were not of a nature to ameliorate his already hopeless state; and those who approached his bedside during his intervals of delirium could well appreciate the poignant grief which oppressed the dying man.

"His delirium, however, was only occasional, and he retained his reason to the last moment. At times, indeed, he entertained hopes of improvement, and then began to think of resuming some investigation, verifying some fact, or examining some opinion: then, as throughout his life, ideas flowed rapidly in his brain; but he breathed painfully, and could not speak without the greatest difficulty. It might then be observed that he endeavoured to include the greatest possible meaning in the fewest words; but his sufferings increased, his respiration became more and more laborious, and he was even denied the consolation of making known his dying thoughts."

It seems to have been towards the end of 1853 that the struggling light was quenched, and the martyr to science released. Of the disposition and moral nature of the man we are told that he was kind, obliging, indulgent in his judgments of others, steady in friendship, firm in his convictions, a hater of injustice, always ready to acknowledge an error, but very sensitive, so that he suffered much from being or apprehending himself to be misconstrued, and fancied he had more enemies than he really had. In a short life, he had yet done his work; and the torch had only burned the brighter for having wasted away so fast.

CHAPTER VIII.

DIVERSITIES OF INTELLECTUAL EXCELLENCE. PAINTERS:—BENJAMIN WEST.

THE ambition of intellectual excellence is the same passion, by whichsoever of the many roads that lie open to it it may choose to pursue its object. The thing that is interesting and valuable is the purity and enduring strength of the passion. These are the qualities that make it both so inestimable in the possession and so instructive in the exhibition. The mere department of study in which it displays itself is of inferior importance; for, even if it should be contended that, of the various pursuits which equally demand the highest degree of intellectual application and devotion, one is yet better calculated than another to promote by its results the general improvement or happiness of mankind, it will scarcely be argued that even those of inferior value in this respect should not also have their followers. The arrangements of Providence, by forming men at first in different moulds, and placing them afterwards in different circumstances, regulate, doubtless with more wisdom and success than could be attained by any artifice of human polity, the distribution of taste and talent and enterprise over the varied field of philosophy and art, no part of which is thus left altogether uncultivated. One man, from his original endowments, or his particular advantages of training or situation, is more fit for one line of exertion, another for another; and, although the pursuits to which they are in this manner severally attracted may not, in the largest view, be of equal im-

portance, that is no reason why we should regret that there are labourers to engage in each. Indeed, the more truly enlightened any mind is, the less ready will it be to look with a feeling either of contempt or of slight respect upon any pursuit which has had power to call forth in an eminent degree the resources of the human intellect. The ground is holy wherever genius has won its triumphs. The farther the domain of science is explored, the more, in all probability, will it be found to be pervaded and connected, in all its parts, by a principle of order, consistency, and unity; and the more confirmations shall we discover of what are almost already universally admitted axioms of philosophy, that no truth is without its worth, and no sort of knowledge without some bearing upon every other.

We are now about to relate the history of some men of genius whose paths have been very different from those of the distinguished discoverers and inventors with whom we have last been engaged. But we shall find that, in every variety of intellectual enterprise, the same devotion and diligence have been exhibited by ardent and generous spirits; and that everywhere these qualities are the indispensable requisites for the attainment of excellence. By no class of students, perhaps, has a greater love of their chosen pursuit been displayed than by Painters. We have already had occasion, indeed, to mention many names from this department of biography, in illustration of the force with which a passion for knowledge has often contended against the most depressing discouragements, and eventually subdued everything that would have prevented its gratification. We have noticed the early difficulties and subsequent eminence of Salvator Rosa, Claude Lorraine, the Caravaggios, our own Opie, and many others. We will now proceed to sketch somewhat more in detail the unpromising circumstances of birth and original situation through which some of the other most distinguished

names in the recent history of English art have had to struggle into light.

The first individual we shall mention was not, indeed, strictly speaking, a native of this country, though he was born a subject of the British crown; but, as an artist, he belongs nevertheless to England. We speak of the late Benjamin West. He was born at Springfield,



BENJAMIN WEST.

near Philadelphia, in North America, in the year 1738. His parents were Quakers, his father being of a good English family, and he was the youngest of ten children. It is related, that his mother brought him into the world immediately after being frightened almost into convulsions by a sermon, in which the preacher scarcely relieved the horrors of a description which he gave of the coming destruction of the world on this side of the Atlantic, by the assurance which he added of the happy destiny in reserve for America, where a new and better order of things was forthwith to arise and be perpetuated, after all vice and evil should have been swept from the earth by that visitation of vengeance. This incident, seemingly of little importance, afterwards exercised

considerable influence on the boy's history. The preacher, flattered by what he probably deemed a proof of the power of his oratory, continued to regard the child with feelings both of pride and kindness; and took pains to persuade his father that, born in such extraordinary circumstances, he would undoubtedly turn out no common man. We shall find presently that these predictions were not thrown away either upon the father or the son.

Meanwhile, however, Benjamin, as might be supposed, grew up without anything marvellous appearing about him, till he had completed his sixth year. Soon after this, one of his sisters, who was married, came to pay a visit to her parents, and brought her child with her. One day, Benjamin's mother having taken her daughter out with her to the garden, they left the child asleep in its cradle, and he was appointed to watch it. As he sat looking at his little niece, she happened to smile in her sleep; and he was so struck with the beauty of the infant, that, there being some paper and pens on the table, and some red and black ink, he immediately attempted to make a drawing of her face. His effort, it would seem, was not altogether unsuccessful; for, when his mother and sister returned, the former exclaimed at once, on obtaining a sight of the paper, which he tried to conceal, "I declare he has made a likeness of little Sally!" Reassured by this, he was in an ecstasy of delight with his new-found art, and immediately offered to make drawings with his black and red ink of the flowers his sister had brought from the garden. So true and delicate a sensibility, thus early awakened, to the beauty of mere expression, showed the genius of the future painter even more than any skill in delineation he can well be supposed to have displayed in this first attempt. Perhaps the circumstance of the boy having been nurtured among the quiet and gentle affections of a Quaker family was not unfavourable to the growth of so

much of the poetical feeling, at least, as he showed on this occasion.

When his father saw this drawing he began to ponder more deeply than ever on the prophecies of his friend the preacher, the fulfilment of which he, doubtless, thought was already begun. As for his son, he went on making ink sketches of birds and flowers, to his own great delight, and the admiration of the simple neighbours. For a year he had no other colour than ink, and only a pen for a pencil; nor, in all likelihood, was he aware that any better resources existed for the practice of his art: for so simple and primitive were the manners and domestic accommodations of the little society of Friends in which he had been brought up, that it is averred he had never at this time seen either a painting or an engraving. At last a party of Indians came to visit Springfield, and were shown some of the boy's performances. They were not very unlike the delineations they themselves were in the habit of making; and these children of the woods were delighted with such evidences of a taste kindred to their own. But their greater experience had given them some advantages over the young prodigy. In particular, they were possessed of colours with which he had no acquaintance, being accustomed to use both a red and a yellow ochre. These, therefore, they taught him the method of preparing; and his mother, to complete his assortment of such new auxiliaries, presented him with a piece of indigo. Still he had no pencil; but, having been told by some one that pencils were made in Europe of camel's hair, his ingenuity soon found out a tolerable substitute for this material. Seizing upon a black cat, which was kept in the house, he extracted the requisite quantity of hairs from her tail for his first brush, and afterwards pillaged her back for others.

About a year after this, a Mr. Pennington, a merchant of Philadelphia, chanced to pay old West a visit, and

Benjamin's pictures were shown to him. Pennington knew a little more of such matters than the villagers of Springfield, and was so much struck with the merit of the boy's performances, that he promised to send him a box of paints as soon as he got back to the city. The box, accordingly, soon made its appearance, and was opened with eager expectation. To an assortment of colours, oils, and pencils, the care of the good merchant had added several pieces of canvass prepared for being painted upon, and half a dozen engravings. Benjamin was perfectly enraptured. The true nature of the prints he did not suspect at first, the existence of such an art as that of engraving never having entered his imagination. But, of course, he thought them the finest things he had ever seen in his life. During the remainder of the evening he scarcely lifted his eye from his box and its contents. Sometimes he almost doubted that he was actually master of so precious a treasure, and would take it in his hand merely to be assured that it was real. Even after going to sleep he awoke more than once during the night, and anxiously put out his hand to the box, which he had placed by his bedside, half afraid that he might find his riches only a dream. Next morning he rose at break of day, and, carrying his colours and canvass to the garret, proceeded to work. Everything else was now unheeded; even his attendance at school was given up. As soon as he got out of the sight of his father and mother he stole to his garret, and there passed the hours in a world of his own. At last, after he had been absent from school some days, the master called at his father's house to inquire what had become of him. This led to the discovery of his secret occupation. His mother, proceeding to the garret, found the truant: but so much was she astonished and delighted by the creation of his pencil which also met her view when she entered the apartment, that, instead of rebuking him, she could only take him in her arms, and kiss

him with transports of affection. He had made a new composition of his own out of two of the engravings, which he had coloured from his own feeling of the proper tints; and so perfect did the performance already appear to his mother, that, although half the canvass yet remained uncovered, she would not suffer him to add another touch to what he had done. Mr. Galt, West's biographer, saw the picture in the state in which it had thus been left, sixty-seven years afterwards; and the artist himself used to acknowledge that in none of his subsequent efforts had he been able to excel some of the touches of invention in this his first essay.

Some time after this, Pennington paid them a second visit at Springfield, and, pleased with the progress the young painter had made since he had provided him with the proper materials of his art, took him with him to Philadelphia. Here he met a brother artist, a Mr. Williams, whose pictures, the first he had seen except his own, moved him even to tears. Williams lent him, also, Fresnoy's Poem on Painting, and Richardson's Essay; and these works contributed not a little to feed his enthusiasm. He returned to Springfield more in love with painting than ever; and so contagious was his ardour, that even his schoolfellows, with hardly an exception, began to follow his example, and no other amusement was minded but drawing on the walls with chalk and ochre. West used to assert that many of the performances of these juvenile amateurs were such as would have done no discredit to the students of an academy. But no one of them, it would seem, had the same deep-seated love of art as himself; for, when the pastime had lasted its season, it was forsaken and forgotten, he alone looking forward to his present pursuit as the occupation of his life, and being resolved to sacrifice everything else for its sake.

He had as yet, however, made no money by his art, not so much even as to enable him to purchase colours

and canvass. But one of the neighbours, a cabinet-maker, having kindly given him some smoothed boards, on which he used to draw his sketches, with ink, chalk, and charcoal, a Mr. Wayne, another neighbour, calling one day at his father's, was shown these performances, and admired them so much that he took a few of them away with him to show to his family or his friends. Next day he returned, and, having resolved by this time to keep the pictures, gave the boy a dollar for each. About the same time a Dr. Jonathan Morris made him a present of a few dollars to buy paints with. These encouragements were invaluable to him at the time; and West never afterwards forgot his first patrons. It does not appear that his father, either at this or any other time, gave him any assistance to enable him to pursue his favourite art, although the family seem to have been in rather comfortable circumstances. If the old Quaker continued to look forward to his son becoming a great man, as the preacher had foretold he would, he seems to have trusted entirely to the efficacy of his reverend friend's prediction to bring about that result. Notwithstanding, however, the pleasure he could not but feel in the uncommon talent which the boy continued to evince by the productions of his pencil, he probably had considerable misgivings, arising from his peculiar religious opinions, as to the lawfulness of the art itself, and wished that the young prodigy would choose another road to the distinction destined for him. Not such were Benjamin's own notions. Ever since reading Fresnoy and Richardson, the profession of a painter had seemed to him the most honourable that man could follow. He had also already got possessed by the prophecy that had been uttered in his favour; and was so persuaded of his future greatness that, finding himself upon one occasion mounted, for a holiday trip, on the same horse with a schoolfellow, who was imprudent enough to confess, in the course of their conversation, that his father intended

to make him a tailor, a trade which, he added, he thought a very good one, West dismounted immediately, exclaiming that no one who meant to be a tailor should ride with him, who was to be a painter,—the companion, as he expressed it, of kings and emperors. This conviction of his high destiny, although it was only in his boyhood that it occasioned such ebullitions as this, never forsook the artist; and, doubtless, contributed somewhat to carry him buoyantly forward through the strange circumstances of his commencing career.

The peculiarity of his situation, indeed, consisted chiefly in this,—that, young as he was, he was left solely to the strength of his own enthusiasm to prompt and sustain him in every effort he made to advance himself in the line he had resolved to pursue. He had no sufferings to endure from want of bread, or from extreme poverty in any of those shapes in which it has so often pressed to the earth the young aspirant after knowledge; but, on the other hand, he had no one to instruct him, or even to urge him to seek instruction. He had everything to do for himself and of himself. The other boys, we have seen, his companions, who also at one time took a fancy to painting, had none of them steadiness or perseverance to pursue the art beyond a few weeks or months. He had no greater external advantages than they had; yet he alone became a painter. He had that within himself which they wanted—that ardour and constancy in the prosecution of his object which has sustained the exertions of all those whose names are to be reckoned with his in the honourable catalogue of self-educated and self-raised men, and without which, indeed, there cannot be achieved anything great or anything worthy. West's history has been described as abounding in fortunate incidents—in the casual occurrence of circumstances favourable to the display and successful operation of his powers; and this is quite true. But, undoubtedly, the luck would have been of no use, but

for the desert which was always ready to take advantage of it. This, indeed, is in many cases the true secret of what is called good fortune; it consists only in the being never unprepared to seize a favourable opportunity when it comes. West, as we shall see immediately, met with a succession of friends to encourage and assist him, as soon as his talents became known beyond his native village; but their aid would have been valueless, and, indeed, they never would have sought him out at all, if he had not cultivated those talents with the extraordinary zeal and industry which he did, when, in his father's house, he neither had nor needed any one to prompt his application, and found difficulty enough even in procuring the necessary implements of his art. He had arrived at his fifteenth year when he attracted the notice of a Mr. Flower, a gentleman of cultivated taste, who resided near the town of Lancaster, at some distance from Springfield. Mr. Flower, having seen some of his productions, was delighted with the talent they displayed, and invited the young artist to spend a few weeks at his house. West derived much benefit from this visit. An English lady, of superior accomplishments, resided in the house as governess to Mr. Flower's children. To this lady Benjamin was indebted for his first knowledge of even the existence of the ancient Greeks and Romans, the lives and characters of whose great men she used to make the frequent themes of her conversation. During his residence here he also got acquainted with another intelligent person, a Mr. Ross, who lived in Lancaster. This gentleman's wife and daughters were remarkable for their good looks; and it was arranged that West should draw their pictures. He acquitted himself in this affair so much to the taste of the people of Lancaster, that numbers of other persons immediately presented themselves to sit to him, and, for some time, he had as much to do as he could manage.

Whether or not Mrs. Ross and her daughters were the

first persons whose portraits he had ever taken, is not stated; but the following is expressly mentioned as the occasion of his first historic painting. One of his Lancaster acquaintances was an individual of the name of William Henry, who had made some money as a gunsmith, and was a man of considerable reading and reflection. Conversing one day with his friend, Henry remarked that he thought it a pity talents of so superior an order should be expended merely in taking likenesses of people whom nobody but their own relations knew or cared about; and suggested how much nobler a use the painter might make of his pencil if he would take some one of the grand scenes of history, and endeavour to transfer it to canvass. He mentioned, as a good subject, the death of Socrates, the story of which he immediately read, probably from some translation of Plato. West liked this idea, and, forthwith proceeding to sketch the composition, in due time produced his first historical picture.

About this time, also, he fell into the hands of Dr. Smith, provost of the College of Philadelphia, who undertook to put him in possession, by a summary process, of as much classical knowledge as it was thought a painter needed. Dr. Smith is said to have been himself a profound as well as an elegant scholar; but he preferred a very superficial mode of teaching in the case of his present pupil. In fact, the knowledge of Latin he communicated to West amounted scarcely to anything. Yet it is probable that he may have derived some advantage from the lessons of his instructor in so far as regarded the enlargement of his acquaintance with the facts of classical history and mythology. In the midst of these studies he fell sick, and was confined, for a considerable time, to his bed—a circumstance which led to his display of a new species of ingenuity. After he had got over the worst of his attack, he one day not a little alarmed both his physician and the other persons

in attendance by insisting that he distinctly saw a procession of phantoms crossing the ceiling of the room, the figures being some of them men, some women, pigs, fowls, &c. Nobody else could discern anything of the kind, and they doubted, notwithstanding the appearances of recovery, whether his brain was not a little affected. But the fact was, that, from having been so long shut up in the darkened apartment, his eyes had distended in accommodation to the diminished light, and had thus acquired a power of distinguishing what was invisible to others. The figures on the ceiling were merely the pictures of objects passing along the street, which were formed by the rays reflected from them, and transmitted through a round hole which happened to be in the window-shutter. This West soon found, when, upon being left alone, he rose from his bed and examined the room, in the determination of discovering the cause of the phenomenon. Having satisfied himself as to how the matter stood, he immediately bethought him that here was a principle of which a useful application might be made; and he soon constructed an apparatus, which, whenever the sun shone, procured him a picture of any object or portion of the landscape to which he chose to turn it. He had, in fact, invented the *Camera Obscura.* When he carried his box, however, to his friend Williams at Philadelphia, that gentleman showed him a much more perfect instrument of the same description, which he had just received from London; so that West found that his invention, though new to himself, would not be so to the world in general.

He now returned home to Springfield. Hitherto, whatever might have been his own views, his father had probably looked upon the boy's picture-making as merely an amusement for a few years of his youth, and had not dreamed of it becoming his profession for life. But, even if he had reconciled himself to such a destination for his son, there were the probable scruples of his

brethren to be overcome. No Quaker had ever before turned artist. Yet, upon the matter being talked over in the family, it soon appeared not only that was the young man's own attachment to the career upon which he had already entered too strong to be shaken, but that his mother also had fixed her affection upon the profession of a painter for her son. In this emergency his father resolved to be guided by the decision of his brethren. The prophecy of the preacher was not yet forgotten, and he was as much persuaded as his wife that their son would yet become a great man, although he did not perhaps so clearly see how. Accordingly he called together the members of the society, and stated the circumstances of the case. We must refer to the pages of Mr. Galt for a description of the consultation. Suffice it to say, that it terminated in a unanimous resolution to permit the young man to exercise the extraordinary talents with which God had endowed him in their proper occupation. Benjamin was forthwith called in, and set apart by something like a consecration to his chosen pursuit. This strange proceeding made an impression upon the mind of the painter, which remained through life, and helped, along with his faith in the announcements of future greatness with which he had been still more early familiar, to strengthen and sustain the enthusiasm with which he devoted himself to art as the one object of his life.

Not long after this he lost his mother, to whom he was much attached; and, when he had recovered from this severe blow, he left his father's house, and, proceeding to Philadelphia, set up there as a portrait painter. This was in the end of August, 1756. He took up his residence in the house of a Mr. Clarkson, his brother-in-law, and soon found sufficient employment. After painting all day, too, he used to spend his evenings with his old friend Dr. Smith, who continued his instructions to him on the beauties of the classics and other matters

of taste. But he had long felt that his professional education would be very incomplete till he had had an opportunity of seeing works of art superior to any which America, at this time, contained. His cherished ambition, therefore, was to visit Rome; and every shilling he could spare was carefully put aside, to enable him to accomplish this object. His terms were two guineas for a head, and five guineas for a half-length. He was obliged to work hard to be able to save anything at these prices; but he had the advantage of gaining, at the same time, a command of hand, and facility of execution, which he could not have attained in the same degree with less laborious practice, and which he afterwards found of great service. He also employed what time he could spare in the study of the higher styles of art; and, among other performances, made a copy from a picture of great merit, which had fallen into Governor Hamilton's hands, through the capture of a Spanish vessel, a St. Ignatius, after Murillo. Of the great superiority of this picture, however, to anything he had yet seen, he was not at this time aware; but Dr. Smith was so much struck by West's copy, that he insisted upon being drawn himself in the attitude of the Saint. While residing in this city, West also executed, for a Mr. Cox, a picture on the subject of the Trial of Susannah—his second historical painting—of which he used afterwards to speak in high terms. It comprehended forty figures, all of which were delineated from nature. From Philadelphia he proceeded to New York, having now a little money in his pocket. Here his reputation brought him many sitters, and, after some time, he raised the price of his half-length portraits to ten guineas. A Flemish picture, which he saw in this city, of a hermit praying before a lamp, inspired him with the desire of painting, as a companion to it, a man reading by candle-light. He was much perplexed, at first, as to how he should proceed, in order to produce the effect of

candle-light on a picture which was, of course, to be seen during the day; but at last he attained his object by making his landlord sit looking upon an open book before a candle, in a darkened closet, while he himself remained painting in the day-light in the adjoining room, from which he had a view of his model through a narrow passage.

When he had been in New York about eleven months, he heard that a vessel was about to sail from Philadelphia direct for Leghorn, with a cargo of wheat and flour, in consequence of the failure of the harvest in Italy. It immediately occurred to him that here was a favourable opportunity of accompl ishing his long-projected visit to Rome. In the mean time the same thought had suggested itself to Dr. Smith; and he received a letter from that gentleman, inviting him to return to Philadelphia without delay. He was, at the moment, engaged in painting a picture of a Mr. Kelly, a merchant of New York, whose name deserves to be remembered for the considerate generosity with which he behaved on this occasion. West, having finished the portrait, communicated to him his intention of going to Italy; upon which Kelly, after paying him his ten guineas, said that he would give him a letter to his agents in Philadelphia, who might be serviceable in giving him directions about his outfit. On reaching Philadelphia, and presenting this letter, the painter was informed that it contained an order for the payment to him of fifty guineas. This was a most welcome addition to his scanty funds, and sent him on board with a light heart.

After touching at Gibraltar and several ports on the coast of Spain, West and his fellow-passengers reached Leghorn, from which the former lost no time in setting out for Rome, after receiving letters of introduction to several of the principal persons in that capital from Messrs. Jackson and Rutherford, the correspondents of

his friend Mr. Allen, of Philadelphia, to whom the vessel and its cargo belonged. He reached Rome on the 10th of July, 1760, in charge of a French courier, with whom he had been provided by his friends at Leghorn, being at this time quite ignorant of the language of the country, and indeed of every language but his own. When a report was spread that a young American had come to study the works of the great masters, the learned of Rome did not know very well what to think of it. The English diplomatist Mr. Robinson (afterwards Lord Grantham), having sought him out, took him to an evening party, where most of the persons were to be assembled to whom he had letters of introduction; and, of course, as soon as he entered the room, most of the company perceived that the transatlantic stranger, in point of outward appearance at least, did not differ materially from any one of themselves. But there happened to be present the celebrated virtuoso, Cardinal Albani, now an old man and quite blind. When West was presented by Mr. Robinson to this personage, as a young American who had come to Italy to study the fine arts, his Eminence, who had no notion that there were any other Americans except the native savages, asked whether he was black or white. Having been set right as to this matter, however, the Cardinal was led to form a very favourable opinion of his new acquaintance—especially after passing his hands over his head, which (being, it would seem, even in those days, a sort of craniologist) he remarked was very admirably formed. Next day West was taken to see some of the great works of art; and so curious were the fashionable world of Rome to observe the effect which these master-pieces would produce on the young Quaker, that he was accompanied by no fewer than thirty of the principal equipages in the city. The first expressions of his astonishment seemed to indicate rather a wild taste to these Italian connoisseurs. When he saw the Apollo he is

reported to have exclaimed, "How like a young Mohawk!" All this notoriety made poor West's ordeal rather a severe one, for, with all his natural talent, he was necessarily deficient in many things which only cultivation can bestow; but, on the other hand, the notice he attracted was calculated to operate greatly in his favour, if he should succeed in satisfying the expectations which were formed of him.

Feeling the necessity, therefore, of doing something to prove himself more than a mere wonder, whose only claim to regard was that he happened to be the first of his countrymen, or of his sect, who had ever come to Rome to study the fine arts, he resolved to present to the Italians some evidence of what he actually could perform with his self-taught pencil. He accordingly asked Mr. Robinson to do him the favour of sitting to him for his portrait; and that gentleman kindly complied with his request. Mr. Robinson was at this time also sitting to the celebrated Mengs, then the most eminent artist resident in Rome; and the circumstance was generally known. When West's picture was finished, Mr. Robinson, concealing the name of the artist, sent it to the house of his friend Mr. Crespigné, where a party was to assemble in the evening. Here it excited great attention. It was generally regarded even by the artists present as the work of Mengs; although some remarked that its colouring was superior to that of most of his performances. But Mr. Dance, an Englishman, having examined it with a very scrutinising eye, pronounced that it was not by Mengs. The colouring, he said, surpassed what was to be found in the works of that artist; but the drawing did not equal his. Meanwhile all these remarks were translated by Mr. Robinson to West, who sat apart on a sofa, all anxiety and agitation. At last it was announced by Mr. Crespigné that the picture was not painted by Mengs—that it was the work of the young American. The surprise of the Italians

was unbounded; but they congratulated the artist warmly. Mengs himself made his appearance soon after, and, having examined the picture, expressed himself, in regard to West's merits, in terms of the most frank and generous commendation. He proceeded to give him advice as to his future studies, telling him he had no need to come to Rome to learn to paint; but that, after examining everything in the city deserving of an artist's attention, he should go successively to Florence, Bologna, and Venice, and, having made himself familiar with the productions of the great masters preserved in these cities, should then return to Rome, paint an historical picture, exhibit it, and, from the opinion expressed of it, decide on the line of art he should follow.

By this time West had been little more than a month in Rome: but such was the excitement he had undergone, that, as happened to Salvator Rosa, he was taken alarmingly ill; on which his medical attendants insisted that he should go back to Leghorn. From Leghorn he some time after proceeded to Florence, in order to consult an eminent surgeon of that city. It was eleven months before he recovered from this attack. During the greater part of this time he remained in a state of extreme weakness and suffering. But even in that condition he did not neglect the study of his profession. He had a table constructed on which he would draw while he lay in bed; and whenever his strength permitted he had his brush in his hand.

Meanwhile, however, this long illness, during which he was probably subjected to some additional expenses, as well as prevented from making any money, was exhausting his scanty funds, and he had arrived at his last ten pounds before he was completely recovered. But at this crisis unexpected assistance arrived. One day, his old patrons in Philadelphia, Mr. Allen and Governor Hamilton, were dining together at the house of the former, when a letter arrived from Allen's Leghorn cor-

respondent, in which, after the customary commercial advices, the writer added a short account of the reception of West's picture of Mr. Robinson at Rome. Delighted with this success of his countryman and protégé, Allen immediately declared that he regarded this youth as an honour to America, and that he was determined he should not want the means of proceeding with his studies. "I shall send him," said the generous merchant, "whatever money he may require." The governor joined warmly in the same sentiments; and insisted on sharing with Allen the honour of supplying the necessities of the young artist. The result of this conversation was, that, when West went to his Florence banker to draw his last few pounds, that person, unfolding a letter, informed him that he was instructed to give him unlimited credit.

From Florence, West proceeded to Bologna, and from thence to Venice, remaining some time at each city, in order to study the works of art which it contained. He then returned to Rome; and, according to the counsel he had received from Mengs, painted two historical pictures, which he exhibited. They were received with great applause. Having now, as he conceived, accomplished every object for which he had been desirous of visiting Italy, he had no other thought than to return to America; when a letter arrived from his father, recommending to him, in the Philadelphian phraseology of that day, first to go for a short time *home*, meaning to England. Although his heart at this time seems to have been still in America, this proposal was not disagreeable to West; and he prepared immediately for his journey to the land of his fathers. Leaving Rome, he proceeded to Parma, where they elected him a member of the academy, a similar honour having been previously bestowed upon him by the academies of Florence and Bologna. He then passed through France, and arrived in London on the 20th of August, 1763. Here he unexpectedly found

his old American friends, Allen, Hamilton, and Smith; and was through their means, and some letters he had brought with him from Italy, speedily made known to Sir Joshua Reynolds and Wilson, the highest names in English art. He soon after, not so much by the advice of his friend as in a well-founded dependence upon his own talents, took apartments in Bedford-street, Covent-Garden, and commenced the practice of his profession. His sagacity had by this time discovered that London afforded a somewhat more promising field for a painter than Philadelphia; and he thought no more of returning to America. One of the first things he did, in order to make himself generally known, was to paint a picture (on one of the same subjects which he had chosen at Rome), and to send it to the exhibition which then took place annually in Spring-Gardens. It appeared here, accordingly, in 1764, and attracted considerable notice. He was some time after invited to dinner by Dr. Drummond, the Archbishop of York, who was so much pleased both with his conversation and the proofs of genius which he conceived his paintings to exhibit, that he contrived to have him introduced to George III. His majesty's favour, which he immediately acquired, placed the artist's rising fortunes upon a sure foundation, and leaves us nothing more to relate of his struggles to escape from obscurity to distinction. The self-taught boy had now won his way to the highest professional employment, and was soon numbered among the best-known painters of the age. It was not the patronage of royalty, however, to which he was really indebted for this elevation. That patronage his own merits chiefly had acquired for him; for all that the happy accidents by which he was assisted could have done for him would have been merely nothing, had not his real talents and acquirements enabled him to take advantage of the favours of fortune. But, with these merits, had he never been noticed at court, he would undoubtedly have found

in time a still more munificent patron in the public. The chief benefit (if it was a benefit) which he derived from the favour of the king, was, that it secured to him at once, and from the first, that independence to which he probably would not otherwise have attained except through the exertions of years. On the other hand, had he been obliged to trust merely to the general appreciation of his merits, his success, if not quite so sudden, might have been more permanent; for he lived, as is well-known, to find, that to rest his reliance, as he did, on the protection of a single individual, however exalted, was after all but to place himself at the mercy of the most common accidents. After having been chiefly employed for more than thirty years of his life in executing commissions for his majesty—during which time he completed the eight pictures illustrative of the reign of Edward III., in St. George's Hall, at Windsor, and the twenty-eight (out of thirty-six which were designed) on subjects from the Old and New Testaments, in the Royal Chapel—he suddenly received an intimation, on the king's illness, in 1809, that the works on which he had been engaged were ordered to be suspended; and he was never called upon to resume his pencil. It was immediately after this that he painted his celebrated picture of Christ Healing the Sick, one of the noblest he ever produced, which he first exhibited to the public, and afterwards sold to the British Institution for three thousand guineas, a much larger sum than he had received for any of the pieces he had executed at the royal command. He afterwards painted many other pictures on similar subjects; continuing to study and work with unabated industry, almost to the very close of his long life. He was always an early riser; and the way in which he spent his day was nearly uniform. The morning hours before breakfast, and generally all the evening after dinner, were given to the study of the subject he was preparing to paint: while, during the

intermediate part of the day, from ten, namely, till four, he was employed without intermission at his easel. All this labour and devotion to his art, besides the improved skill and excellence which practice gives, enabled West to produce an unusually great number of works. His pictures in oil amount to about four hundred—many of them of extraordinary size, and containing numerous figures. In 1791, on the death of Sir Joshua Reynolds, West was appointed President of the Royal Academy, which had been established in 1768. This honourable office (with the exception of one year) he held till his death, on the 11th of March, 1820, in the eighty-second year of his age.

One serious disadvantage, however, which West brought upon himself, by the almost exclusive attention he had given to painting from his earliest years, was, that he remained to the end of his life a somewhat illiterate man. It has been asserted, that to spell his words correctly, when he had anything to write, was a task of no little difficulty to the President of the Royal Academy. This neglect and ignorance of everything not immediately appertaining to the department of their own favourite study has been, perhaps, as frequently exemplified by painters as by any other class of self-educated men. The celebrated Claude Lorraine could scarcely write his name. Our own Hogarth, although, by the assistance of a friend, he appeared on one occasion as an author, affected to despise literature, and, indeed, every species of mental cultivation, except the knowledge of the art of painting; nor did he much exaggerate when he professed to have himself little or no acquaintance with anything else. It would be easy to mention other instances of the same kind. They ought to serve as warnings to the individual who, with an ardent desire for knowledge, has no one to guide him in its acquisition, of a risk to which he is peculiarly exposed. Even the great artists we have named, with capacities that might

have compassed any attainments in literature or philosophy, must be held, notwithstanding all they did, to have neglected a duty they owed to themselves, or, at least, to have followed a lamentably mistaken course, in disregarding that general cultivation, without which excellence in any department of art may almost be said to lose the character of a liberal accomplishment.

CHAPTER IX.

OTHER ENGLISH PAINTERS:—SPENCER; HIGHMORE; HANNAM; WRIGHT; GILPIN; GAINSBOROUGH; BARRY; LAWRENCE.

MANY others of our recent English painters have been almost as entirely their own instructors as West was. JARVIS SPENCER, who was celebrated as a miniature painter in the latter part of the last century, was originally a menial servant, and while in that condition used to amuse himself by attempting to draw, when no one suspected what he was about. At last, one of the family in whose service he lived having sat to an artist for a miniature, the performance, when it was finished, was seen by Spencer, who immediately remarked, very much to the surprise of everybody, that he thought he could make a copy of it. He was allowed to try his skill, and succeeded to admiration. His master, upon this discovery of his servant's genius, very generously exerted himself to place him in his proper sphere, and to make him generally known; and Spencer, as we have said, rose eventually to great eminence in the department which he cultivated. JOSEPH HIGHMORE, who painted, among other well-known works, the Hagar and Ishmael in the Foundling Hospital, and long enjoyed high reputation, both for his historical pictures and his portraits, taught himself the art which he afterwards practised with so much success, while he was serving his apprenticeship in a solicitor's office and was without any one to give him a lesson. Highmore died in 1780. Another painter of that day, of the name of HANNAM, whose works, however, have not attracted much attention, was originally an apprentice to a cabinet-maker; and, having

acquired some skill in painting by his own efforts, used to be allowed by his master to spend as much of his time as he chose in executing pictures for those who gave him commissions, on condition of his handing over the price to that person, who found that he made more in this way than he could have done by keeping Hannam to his regular work. RICHARD WRIGHT, who about the same period was much celebrated for his sea-pieces, rose from the condition of a house and ship painter, having taught himself to draw while he followed that trade in his native town of Liverpool. The late Royal Academician, SAWREY GILPIN, so celebrated especially for his faithful and spirited delineations of animals, was also originally apprenticed to a ship-painter. He lodged in Covent-Garden, and, there being a view of the market from the window of his apartment, Gilpin used to amuse himself in making sketches of the horses and carts, with their attendants, as they passed, or formed themselves into picturesque groups in the square. GAINSBOROUGH, the great landscape painter, again, led by his different genius, used, while yet a mere boy, to resort to the woods and pasture fields in the neighbourhood of his native town of Sudbury, and there to employ himself unweariedly, often from morning till night, in sketching with his untutored pencil the various objects that struck his fancy, from a flock of sheep, or the shepherd's hut, to the stump of an old tree. It was to these studies of his earliest years, undoubtedly, that Gainsborough was indebted both for that perfect truth and fidelity by which his works are distinguished, and for that deep feeling of the beautiful in nature which has thrown over them so great a charm. He learned also in this way a habit of diligent, minute, and accurate observation, which never left him; and it is both interesting and instructive to read the account which has been given of the unrelaxed zeal with which he continued to pursue the study of his art even to the last. "He was con-

tinually remarking," says Sir Joshua Reynolds, speaking of the habits of his more mature years, "to those who happened to be about him, whatever peculiarity of countenance, whatever accidental combination of figures, or happy effects of light and shadow, occurred in prospects, in the sky, in walking the streets, or in company. If in his walks he found a character that he liked, and whose attendance was to be obtained, he ordered him to his house; and from the fields he brought into his painting-room stumps of trees, weeds, and animals of various kinds; and designed them, not from memory, but immediately from the objects. He even framed a kind of model of landscapes on his table, composed of broken stones, dried herbs, and pieces of looking-glass, which he magnified and improved into rocks, trees, and water; all which exhibit the solicitude and extreme anxiety which he had about everything relative to his art; that he wished to have his objects embodied, as it were, and distinctly before him, neglecting nothing that contributed to keep his faculties alive, and deriving hints from every sort of combination." It is not, indeed, generally, the highest genius which is least inclined to avail itself of such assistance in its labours as study and pains-taking may procure.

Another of the most distinguished names in the list of British artists of the last century is that of JAMES BARRY. Barry was born at Cork in 1741. His father appears to have been a somewhat unsettled character, or at least to have shifted from one pursuit to another, probably without obtaining much success in any. It is commonly said that he was originally a mason; some authorities state that he had been also a victualler. At the time of Barry's birth he was the master of a small coasting vessel, in which he traded between England and Ireland.

Barry is understood to have received a good education in the ordinary branches of scholarship. At an early age, however, his father took him with him to sea, and

made him do duty as a ship-boy. This occupation he detested. The love of painting had already taken possession of him, and his greatest pleasure was to cover the deck with sketches of objects made with chalk or ochre. His father, at last, finding all his efforts to make him a sailor of no avail, allowed him to remain at home, and to pursue his studies in literature and art. He now returned to school, and distinguished himself by an ardour and diligence which left all his class-fellows behind him. Even his play-hours were generally given to hard study. Instead of associating with the other boys in their amusements, his practice was to retire to his room, and there to employ himself in reading or painting. Whatever money he got, he spent in purchasing books, or candles to enable him to read during the night. His enthusiasm was at this time (and indeed throughout his life) partly sustained also by certain notions of the virtue of ascetic observances, which he



JAMES BARRY.

had derived from his mother, who was a Catholic, and had great influence over him. In conformity with these

opinions he was wont to sleep, when he did take rest, upon the hardest bed, and to wear the coarsest clothes he could procure. These theological prejudices were not calculated to have a salutary effect upon the growth of a character like that of Barry, whose morose and atrabilious temperament rather required an education calculated to bring the gentler affections of his nature more into play.

His ardour in study, however, both during this and every other part of his life, was admirable. He had as yet but few books of his own, but he borrowed from all who had any to lend, and sometimes learned the passages which he liked by heart (a practice of which he soon found the advantage in the growing strength of his memory), and sometimes transcribed them. It is said that transcripts of several entire volumes, which he had made at this period, were found after his death among his papers. Among the works which he especially delighted to study, it is recorded, were many on controversial divinity—unfortunately not the most wholesome sustenance for an intellectual and moral organization like his.

He was in his seventeenth year when he first attempted to paint in oil; and for some years he wrought with no one to encourage or to notice him. Among the first performances which he produced were compositions on the escape of Æneas from Troy, the story of Susannah and the Elders, and that of Daniel in the Lion's Den. These pictures he hung up on the walls of his father's house, and there they remained long after the painter's fame had spread over Europe. At last, in his twentieth or twenty-first year, he produced a work which appeared to himself such as he might exhibit in a more public place. This was a picture on the fine subject of the baptism by St. Patrick of one of the kings of Cashel, who stands unmoved while the ceremony is performed, amidst a circle of wondering and horror-struck spectators,

although the saint, in setting down his crozier, has, without perceiving it, struck its iron point through the royal foot. With this work he set out for Dublin, and placed it in the exhibition-room of the Society for the Encouragement of Arts. It was universally admired. But no one knew the artist, or was aware that he was a native of the country; and when Barry, who used frequently to come to the room to observe the impression it made, dressed in the same coarse attire which he wore in the country, one day, overcome by emotions which he could no longer conceal, announced himself the painter of the picture, his avowal was received with an incredulous laugh. He burst into tears and left the room. The patriotic enthusiasm of his countrymen, however, amply recompensed him for this when they found that he, an Irishman, was really the person who had produced this admired performance. The young ascetic soon found himself the favourite of the gayest society of his native metropolis. But perceiving that this new course of life interrupted his studies, and seduced him occasionally into worse follies, he became alarmed, and determined to withdraw himself from it before it should have become a habit. These feelings came over him with so much force one night when he was returning from a tavern where he had spent the evening with a bacchanalian party, that he actually threw what money he had in his pocket into the river, cursing it as having betrayed him into the excesses of which he had been guilty, and from that day returned to his books and his easel.

Meantime, however, he had also acquired some worthier friends; and, among others, had been introduced to the illustrious Edmund Burke, then commencing his splendid political career as assistant to the secretary of the Lord Lieutenant. A story has been told respecting Barry's first interview with Burke, which would be interesting if it could be received as true. Having got

into an argument with each other, Barry is said to have quoted a passage from the 'Essay on the Sublime and Beautiful' in support of his opinion; on which Burke expressed himself slightingly of that anonymous performance. This insensibility to the merits of a work which was one of his especial favourites, fired Barry, and, after vehemently eulogizing the book, he concluded by declaring, that not having been able to purchase it when it first came into his hands, he had actually transcribed the whole of it. His surprise and delight were extreme, when, in reply to this appeal, the other told him that he was himself the author of the work. "And here," exclaimed Barry, taking a bundle of papers from his pocket, "is the very copy I made of it with my own



EDMUND BURKE.

hand." All the truth that there probably is in this story is merely that Barry quoted Burke's own essay in

reply to some of that gentleman's arguments. He could hardly have been ignorant that Burke was the author of the work, which had been published so far back as 1757, at least five or six years before the interview in question is stated to have occurred.

But Burke did not satisfy himself with merely bestowing upon his young countryman the patronage of his favourable regard. Although, at this time, his income was a very limited one, he most generously undertook to provide the means of sending Barry to Italy, and supporting him there while he nourished and matured his genius by the study of the works of the great masters. Accordingly, after he had been seven or eight months in Dublin, the young artist proceeded, at Burke's invitation, to London, where the latter now resided. For a short time he was occupied in making copies of some paintings in oil for James Stuart, the author of the 'Antiquities of Athens;' an employment which Burke procured for him, and which was well calculated to improve him in his art. In the end of the year 1765 he left London for the Continent, and, passing through France, proceeded to Rome. He remained absent from England about six years in all, during the whole of which time Burke, assisted by his two brothers, supplied the funds necessary for his support. During his residence at Rome, Barry was not idle—that, with all his faults, he never was at any time of his life—but his studies were not always directed so wisely as they might have been to the object which he ought to have had principally in view; and his unfortunate temper involved him in continual quarrels with his brother-students. He received from Burke the best advice, administered in the kindest manner; but all failed to have much effect.

He made his re-appearance in London in the beginning of the year 1771, and immediately proceeded to give proofs of his improved powers, by painting some

pictures, which he exhibited. But it was not his fortune to meet with much applause. All his performances were characterised by certain obvious defects of execution, which struck everybody, while their merits were frequently not of a kind to be appreciated by the multitude. Among other pictures he painted one, in 1776, on the death of Wolfe, in which, as had been usual in such pieces, the combatants were represented naked, it being in those days held impossible to preserve any heroic effect where modern costume was introduced. But just at this time West produced his noble picture on the same subject, in which all the figures were painted dressed as they had actually been; and the force of nature and truth carried it over the scruples of criticism. Barry's performance was found quite unequal to sustain any competition, in point of attraction, with its rival. This and many other disappointments he had to bear: nor were those the least of his vexations which he brought upon himself by his own absurd and ungovernable temper. He had been before this time chosen an Associate of the Royal Academy, but he had already quarrelled with the Council. His wayward and ungrateful conduct at length wellnigh tired out even the friendship of Burke. To add to all this, his pencil, his only resource, brought him but the scantiest returns; and his days were darkened by the miseries of severe poverty.

Yet all did not crush his spirit. While struggling with these complicated distresses, he continued to worship his art with as warm an enthusiasm as ever. In a letter, written when he was in Italy, to his friend Dr. Hugh, he had said, "My hopes are grounded in a most unwearied, intense application; I every day centre more and more in my art; I give myself totally to it; and, except honour and conscience, am determined to renounce everything else." In addressing himself, about the same time, to another friend, he exclaims, in touch-

ing anticipation of the fate that awaited him, "O, I could be happy, on my going home, to find some corner where I could sit down in the middle of my studies, books, and casts after the antique, to paint this work and others, where I might have models of nature when necessary, bread and soup, and a coat to cover me!" He had now hardly the prospect of securing even these humble accommodations, when he nevertheless determined, for the honour of historic painting, to devote himself to the accomplishment of a great work, requiring much time and labour, and holding out to him at the best only a scanty, distant, and precarious remuneration. He proposed to the Society for the Encouragement of Arts, Manufactures, and Commerce, to adorn their great room in the Adelphi with a series of compositions on some appropriate subject by his own hand, on condition only of being allowed to choose his subject, and of being provided with the necessary canvass, paints, and models, This was in the year 1777. He had just before published an elaborate work in refutation of the theories of some continental critics, who had maintained the impossibility of the higher style of art ever flourishing in England, on account of the climate being too northerly and cold; and he now thought himself bound, he informs us, to follow up his argumentative vindication of the national genius by a proof of what it could produce, "in duty," says he, "to the country, to art, and to my own character." He calculated that this work would cost him the constant labour of two years, and he knew that he must, during all that time, procure himself the means of existence by additional toil in hours stolen from sleep. But the prospect of these things had no power to deter him. With only sixteen shillings in his pocket he entered upon his undertaking, determined, if only life should be granted him, to accomplish it upon the terms he had proposed.

And he would probably have been able to keep to the

letter of his engagement, if the work had cost him no longer time than he originally contemplated. But, although he laboured diligently and unceasingly, he found it impossible to finish it in less than six years, instead of the two which he had thought would be sufficient. The subject which he chose was the Progress of Human Improvement, which he has represented in a series of six pictures. Of these he intended the first to be emblematical of the savage state, or rather of the earliest dawn of civilization, when the chace was the only employment of men, and their rude natures were just beginning to be attempered to the influences of religion, law, and music; the second, of the age of agriculture; the third, of the establishment of civil polity, and the reign of literature, science, and the arts; the fourth, of the modern triumphs of navigation; the fifth, of the age of manufactures and commerce; and the last, of Elysium, or the immortal happiness of the great and good in a future state of existence. The conception of these different compositions displays considerable learning and ingenuity; but the subject attempted to be illustrated scarcely lies, perhaps, within the legitimate province of painting. At any rate it has been generally felt that Barry's allusive groups and figures often shadow forth but very dimly and imperfectly what he means them to represent; and, indeed, that without his own printed explanations they would be sometimes nearly unintelligible. If, however, he overrated his own powers, or those of his art, in undertaking this task, the manner in which he prosecuted and accomplished it (in so far as he found its accomplishment possible) must be allowed to form as fine a display of zeal, disinterestedness, self-denial, and heroic perseverance as is anywhere to be found on record. During the six years which were devoted to the execution of these pictures, the enthusiastic artist led, voluntarily and contentedly, a life of incessant toil and privation. Wearing, as usual, the

coarsest clothes, and living upon the humblest fare, his limited personal expenses still compelled him, not unfrequently, after working ten hours at the Adelphi, to sit up half the night painting or engraving something for the booksellers, with the price of which he might purchase bread for the following day. At last, however, he was obliged to make an application to the Society of Arts for some assistance to enable him to continue his labours, and, after some delay, they voted him a hundred guineas. They also presented him with two hundred guineas more on the conclusion of his undertaking, and permitted him to exhibit the pictures to the public, by which he realised about five hundred pounds. These sums, together with about two hundred and fifty pounds more, which he derived from the admiration of a few affluent individuals, formed all the remuneration he received for his six years' labours. But, inadequate as it was, it was more than he had counted upon. It deserves to be mentioned to the credit of Barry's prudence, that, as soon as he obtained this money, he placed it in the funds, not having, it would appear, even during the long period he had existed almost without any income at all, incurred any debts which it was now necessary for him to discharge. He thus secured an income for the rest of his life, which, although small, was an independence to a person of his economical habits; and, indeed, added to the fruits of his daily industry, it enabled him afterwards to save money.

Barry lived for many years after the completion of these paintings at the Adelphi, during which he continued his studies and his professional labours as assiduously as ever, and, although not much encouraged by popular favour, produced numerous works of various degrees of merit. While yet engaged with his great undertaking which has just been described, he was elected Professor of Painting to the Royal Academy; and, as soon as he had finished the pictures, he com-

menced his lectures. He also, in the course of his life, published various literary works, which, together with his Lectures and Correspondence, have been collected since his death, and form two volumes quarto. He died in February, 1806, having been suddenly attacked by a pleuritic fever, which carried him off in a few days, in the sixty-fifth year of his age.

The biographies of many men are as instructive from the details which they present of the unhappy consequences that have flowed from errors of conduct or constitutional failings, as those of others are from their pictures of success won by merit. To the young and inexperienced, lessons of warning are as necessary as lessons of encouragement. It often happens that great excellences are combined in the same individual with great defects; and it is exceedingly requisite that, while he is taught and made to feel what may be accomplished by a due application of the one, it should also be deeply impressed upon him that the other, if indulged or allowed to remain uncorrected, may render the best abilities, and even the most arduous exertions, useless. The utter insufficiency of mere talent, indeed, to attain either independence or honourable distinction, when unaccompanied by habits of industry and perseverance, has been too often exemplified to make it necessary that we should cite any instances in proof of it. Even the highest powers unemployed must remain unproductive. But the history of Barry illustrates another case which also sometimes occurs—that of a person who, uniting great capacity and unwearied application, still fails in obtaining the success he might have expected, from the want of other qualities. The deficiencies and mistakes of this able man were chiefly such as are peculiarly apt to mark the temper and conduct of persons who, in early life, have been entirely or principally their own instructors. Such persons, before entering the real world, in which they must mix with their fellow-men, have

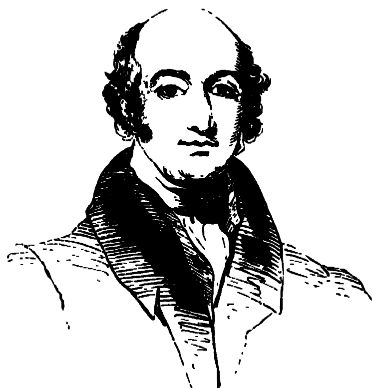
commonly created, as it were, around themselves a world of their own, to which all their notions and habits are accommodated, having been there, in fact, formed and learned. Their associates in ordinary life have not hitherto acquired any of their respect, by having guided or assisted, or even participated with them in those studies which they have pursued with so much ardour. They have here had to do everything for themselves, and have found themselves sufficient for everything. From all this naturally springs some weakness, as well as much strength :—on the one hand, an independence and self-reliance, both moral and intellectual, begetting generally a manner of thinking unusually manly and unprejudiced, and sometimes considerable originality of view ; but, on the other, an ignorance of the actual world and of mankind, an undue impatience of and contempt for the ordinary conventional forms and arrangements of society (which are all founded upon the principle of mutual concession among many variously fashioned or variously feeling minds), a bigotry in favour of certain peculiar notions which will brook neither contradiction nor advice; in one word, such an excess of the spirit of confidence and aversion to control as amounts sometimes to positive perversity and wilfulness. The character of Barry exhibited, in strong relief, both the good and the bad qualities we have mentioned. The love of his art was with him a passion. He pursued, throughout his life, the study and the practice of it with a zeal and a laborious application which no difficulties and no discouragements could abate. He possessed in sufficient measure that trust in his own powers, without which nothing great can be either achieved or attempted. And he both thought and wrote with a force and decision which showed a mind unenervated by the habit of taking its opinions from others, and capable of stamping its own impress upon whatever subject it investigated. But

this masculine energy and hardihood of nature, from having been allowed to grow up undisciplined, very early degenerated into a species of recklessness and ferocity, which proved the blight of his genius and the curse of his existence. His arrogance and infirmity of temper, as well as his imprudence and his extraordinary ignorance of the world, showed themselves almost in the very commencement of his career. Scarcely had he set his foot in Rome, when he discovered (to his own satisfaction) that all the principles and maxims there recognised with regard to the art he came to study were stupidly wrong, and he forthwith not only denounced them as such, but quarrelled with everybody who chose to stand up in their defence. It is possible that he may have been right in his judgment; but somewhat more of forbearance in the expression of it, and of toleration for the opposite opinion, would have savoured both of charity and of wisdom. From something of the same spirit of opposition and contumacy, he would not, while here, pursue the same method of study as his brother artists; but, instead of employing himself in making drawings of the works of the great masters with his hand, he satisfied himself with taking fac-similes of them by an instrument. He even spent much of his time, as we have already mentioned, in the investigation of subjects hardly connected at all with his proper occupation. All this while he had, in his friend Burke, an invaluable monitor, whose counsels continued to be tendered to the last with a frankness, and, at the same time, a delicacy in the manner, only equalled by the admirable wisdom of the matter. But, although he felt the kindness, and, at times, even the unanswerable good sense of the advice he received, it certainly produced no effect upon his conduct. On his return to England, as we have seen, he acted in the same manner as he had done at Rome—attacking and quarrelling with everybody, insisting

upon having his own way in everything, too often apparently out of a spirit of selfishness, or the mere love of dispute and opposition, and, in short, in his whole conduct regarding nothing save his own humours and impetuous impulses. To deport himself after this fashion, he seems to have thought was a privilege he possessed as a man of genius—a weak mistake, which, if his genius had been of the highest kind, he never would have fallen into. How much truer a wisdom than that which his own ill-regulated temper and childish notions of dignity suggested to him, might he have found in a few sentences of one of the letters addressed to him by Burke, a short time before he returned from Italy: "Believe me, my dear Barry," writes this considerate friend, "that the arms with which the ill dispositions of the world are to be combated, and the qualities by which it is to be reconciled to us, and we reconciled to it, are moderation, gentleness, a little indulgence to others, and a great deal of distrust of ourselves; which are not qualities of a mean spirit, as some may possibly think them, but virtues of a great and noble kind, and such as dignify our nature as much as they contribute to our repose and fortune; for nothing can be so unworthy of a well-composed soul as to pass away life in bickerings and litigations; in snarling and scuffling with every one about us. Again and again, my dear Barry, we must be at peace with our species, if not for their sakes, yet very much for our own."

We may add a sketch of the career of another English painter, of great distinction in one branch of the art, who also was mainly self-taught, the late Sir THOMAS LAWRENCE. The boyhood of this great artist exhibited almost as remarkable an instance of the precocious development of talent as any on record. He was born in 1769, being the youngest of a family of sixteen children. His father had been bred an attorney, but

had afterwards become an Excise officer, and, when his son Thomas was born, was an innkeeper at Bristol; which city, however, being unsuccessful in his business, he left a few years subsequent to this event, and established himself in the same capacity at Devizes. He appears to have been a strange character, as indeed this outline of his history would itself lead us to suppose. His ruling passion, it seems, was a love of poetry; and this he carried so far as not only to spend much of his own time in writing verses, but often to insist that his guests also should postpone all other affairs to listen to his effusions. How he found this sort of treatment to answer in attracting or attaching customers to his house, may be easily conceived. All who did not prefer such intellectual banquets to more substantial fare gradually deserted the rhyming innkeeper, by whom, of course, many matters of consider-



SIR THOMAS LAWRENCE.

able, though merely terrestrial, importance were apt to be neglected, while he was employed in the service

of the Muses. The consequence was, that in six or seven years his Devizes speculation also failed, and old Lawrence was once more ready for a change of residence, if not of profession.

Long before this, however, his son Thomas had become famous in the neighbourhood as a little prodigy. He was a very beautiful boy, and had been remarkable from infancy for his sprightly and winning manners. His father, whose favourite he was, had early taught him to recite poetry; and when the child was only four or five years old, it was common for him to be presented by his partial parent to all strangers who visited the house, to exhibit to them his proficiency in this accomplishment. But, even at this very early age, he had acquired considerable mastery in a species of performance much more difficult than that of spouting verses. He was able already to use his pencil, and to take likenesses. This art he had acquired entirely of himself—if we should not rather say that, appearing as it did with the very commencing development of his intellectual powers, it was more a faculty born with him than an art which he had to learn. It was several years after he began to draw before he had an opportunity of seeing a good painting. He had not only, therefore, to form himself merely by copying nature, but to invent the mechanical processes of his art by his own ingenuity, without either a master or a model. Yet the portraits which he sketched even so early as his fifth year are affirmed to have been generally happy likenesses; and one of Lady Kenyon, which he executed at this period, is particularly recorded as having been at once recognised when shown to a friend of her ladyship twenty-five years after.

At the age of six he was sent to school, but he was only allowed to remain two years; and this, with the exception of a few lessons in Latin and French some time afterwards, was all the education he ever received.

The uncommon talents he had displayed had now made him generally known; and one gentleman generously offered to defray the expense of maintaining him for some years in Italy, that such extraordinary natural powers might not be deprived of the advantages of the best possible cultivation. But his father had very absurdly taken it into his head that instruction would only cramp and weaken his son's genius; or, at least, he chose to say that such was his opinion; and, upon this pretext, he not only refused to permit him to go to Rome, but would not even hear of his taking lessons from a master in his own country. He allowed him, however, to visit the houses of some of the neighbouring gentry, where he saw some good pictures; and these first gave him an idea of historical painting. He copied various pieces of this class, and at last produced several original compositions of his own.

His father had probably for some time before leaving Devizes resolved to make an attempt to turn his son's singular talents to some account; and it may have been partly with this view that he declined allowing any lessons to be given to the boy. He considered, of course, that he would attract more wonder by being presented to the public as an entirely self-taught genius, than if it should have to be acknowledged that he had derived any part of his skill from the instructions of others. When Mr. Lawrence gave up his inn at Devizes, Thomas was about ten years of age. The whole family immediately proceeded to Oxford. As soon as they arrived in this city the boy's qualifications were announced; and numbers soon thronged to him to have their likenesses taken. The commencement of the speculation was thus sufficiently successful. From Oxford they removed to Salisbury, and thence to Weymouth; and at both places the talents of the young artist reaped a considerable harvest. At last, in 1782, Mr. Lawrence proceeded with his son, and the rest

of his family, to Bath, where he proposed to fix his future residence. Thomas was at this time in his thirteenth year.

On his arrival in Bath he found the persons of distinction assembled in that fashionable place of resort familiar with his name and his extraordinary abilities; and sitters soon came to him in such numbers, that he raised the price of his crayon portraits from a guinea to a guinea and a half. Some of the persons by whom he was noticed, also, possessed valuable collections of pictures,—and these he used to employ much of his time in studying and copying. Among other copies which he made was one of the Transfiguration by Raphael. This he sent to the Society of Arts; and although, in consequence of an informality, it was found not to be admissible as a competitor for any of the regular prizes, the Society were so much struck by its merits that they bestowed upon the young artist their large silver palette, gilt, and five guineas in money.

He remained at Bath about six years; and during the whole of this time, young as he was, he was the sole support of his father and the rest of the family. He is said to have worked regularly in painting portraits at least four hours every day,—besides which, he spent much time in studies and voluntary exercises connected with his art. At last his father, to whom he had so long brought a considerable income, either thinking that his labours might be made still more profitable in a larger field, or perhaps prevailed upon by the remonstrances of the young man himself, determined to remove his establishment to London. The family arrived here in 1787, when Thomas was in his eighteenth year. His coming to London at this time was undoubtedly a fortunate event in every way for the artist. The folly, or more interested views, of his father had hitherto withheld from him all the ordinary means of improvement in his profession; but he himself, it is understood, with

more good sense, felt anxiously desirous to be able to avail himself of better opportunities of study than he could enjoy in the country. When he found himself in London, accordingly, he hastened to procure admission as a student at the Royal Academy. He also got himself introduced to Sir Joshua Reynolds, to whom, then



SIR JOSHUA REYNOLDS.

in the height of his fame, his father would seem to have intended that he should at once set up as a rival,—having, in the first instance, established him in an expensive suite of apartments in Leicester-square, in the immediate neighbourhood of the rooms of the great painter. In this matter, also, however, his son acted more modestly, and more wisely. He sought access to Sir Joshua's study with one of his performances in his hand—submitted the picture to his inspection—and listened to his remarks with the attention and deference of one who both knew their value and how to profit by them. He also very soon removed from

Leicester-square to less splendid lodgings in Tavistock-street, Covent Garden.

Such was the early history of Sir Thomas Lawrence. His subsequent career, as all know, was one of great brilliancy. He was elected a Royal Associate in 1791. On the death of Sir Joshua Reynolds, the following year, he was appointed his successor in the offices of painter to his Majesty and to the Dilettanti Society. From this time his reputation grew steadily, till he came to be generally acknowledged the first portrait-painter of the age. In 1815 the honour of knighthood was bestowed upon him by the Prince Regent. The preceding year, on the visit of the foreign sovereigns to this country, he had received his Royal Highness's commands to take the likenesses of these personages, and some of the more distinguished individuals in their suite; and, during their stay, he finished the portraits of the King of Prussia, Field-marshal Blücher, and the Hetman Platoff. Four years afterwards, on occasion of the Congress at Aix-la-Chapelle, he repaired to that city, where he painted the Emperor Alexander; and, proceeding from thence to Vienna, he there completed portraits of the Emperor of Austria, the Archdukes, Prince Metternich, and other distinguished persons belonging to that court. From Vienna he went to Rome, where he arrived in May, 1819. Here he painted the Pope, Pius VII., and Cardinal Gonsalvi. He remained in Rome for several months, during which he received the most gratifying testimonies of respect and admiration from his brother artists there, and it was not till the month of April, 1820, that he returned to England. The day before he arrived in town he had been unanimously elected to the Presidency of the Royal Academy, as successor to Mr. West. This distinguished office he continued to hold till his sudden and lamented death, on the 7th of January, 1830. Only

the day before this event happened, he had worked for some time in his study, as usual; and even a few minutes before he expired, he had been conversing cheerfully with some friends who had spent the evening with him, on the art which he loved, and which it was then little thought by any of them he would so soon cease to adorn.*

Gifted as he was with such an extraordinary natural capacity for his art as to have been in reality a miracle of precocity, Sir Thomas Lawrence does not furnish us with an example so valuable as many others we have quoted, with reference to the peculiar object of the present work. His first acquisitions in the line in which he afterwards so greatly distinguished himself were not made either through laborious application or in the face of any uncommon difficulties; but rather by a happy innate skill and facility, which enabled him to paint and draw likenesses almost as soon as his hand could hold a pencil, and with something approaching to the same unconsciousness and absence of effort with which in other men the limbs obey the impulse of volition in their most ordinary movements. But still his history is not altogether uninstructive, even as a lesson on the subject of the pursuit of knowledge. Although in his earliest efforts he met with no opposition, but on the contrary, with abundance of encouragement and applause, from his father, we have seen the resistance which that person afterwards offered to every plan which was proposed for his son's improvement; and it is to be taken, therefore, as an evidence both of great good sense and no ordinary firmness on the part

* The facts here stated are mostly taken from an interesting narrative of Lawrence's early life, given in the first volume of the *Juvenile Library*. Since the present work was first published, there has appeared 'The Life and Correspondence of Sir Thomas Lawrence;' by D. E. Williams, Esq. 2 vols., 8vo. London, 1831.

of the son, that, not intoxicated either by the flatteries which had been lavished upon him, or by the decided success which had crowned even his yet imperfect performances, he felt, what his father did not, how useful study and instruction might be to him, and, as soon as it was in his power, took measures of his own accord to secure both. Had this eminent artist, indeed, not possessed many other superior qualities beside his talent as a painter, the education which he received in his boyhood, suited as it was to force out his genius into brilliant but premature display, would, in other respects, have been productive of very unfortunate effects on both his professional and his general character. He must have been very active in availing himself of such opportunities as his after life presented for repairing the injuries of his early training. He is one of a very few of our great English painters (Gainsborough was another) who have attained to eminence in their art, without having enjoyed the advantage of an early residence in the country which contains the principal works of the great masters. Sir Thomas Lawrence never visited Italy till he went there, as we have mentioned, on his return from Vienna, in 1819, when he was fifty years of age. This was one misfortune which he owed entirely to the obstinacy of his father. Considering the very scanty education, too, which he received in the ordinary branches of learning, the respectable measure of literary information of which he afterwards made himself master deserves to be mentioned to his credit. Although not what is commonly called a scholar, he was well acquainted, we are told, with the best English authors; and had taken great pains to obtain a knowledge of classical and foreign works, in so far as they were accessible to him through translations. Finally, the sober and rational equability of temper and conduct, so opposite both to the low

excesses of Morland and the morbid cynicism of Barry, which this eminent artist preserved throughout his life, notwithstanding his early exposure to so many influences well calculated to corrupt both his understanding and his heart, forms another ground on account of which his example is exceedingly worthy of being held up to the imitation of all, and especially of such as may have to tread a path so perilous as his, in the commencement of life.

CHAPTER X.

FOREIGN PAINTERS:—GIOTTO; GREUZE; EHRET; SOLARIO.—OTHER CULTIVATORS OF THE FINE ARTS:—CANOVA; BEWICK.

If we were to go over the long catalogue of foreign painters, we should find many names to add to those we have already enumerated of individuals who have attained the highest distinction after acquiring their art originally without a teacher, or practising it for a considerable time in unnoticed obscurity. Giotto, for instance, one of the great revivers of the art in the beginning of the fourteenth century, was the son of a peasant in the village of Vespignano, near Florence, and was employed, when a boy, in tending sheep. While in this condition, he was one day found by Cimabue drawing the figure of one of his flock on a large stone which lay on the ground; and that master (the first who practised anything deserving to be called painting in modern Europe) was so much pleased with this attempt, that he took the boy with him to Florence, and carefully instructed him in his art, in as far as he knew it himself. Giotto afterwards greatly surpassed his master, and, indeed, had no equal in his own age, either as a painter or a sculptor. To descend to much later times, Batoni, the principal artist whom Italy produced in the last century, taught himself painting while working with his father as a goldsmith; and, although he afterwards went to study at Rome (being sent there by some admirers of his genius, who subscribed to defray the expense of his residence), he merely availed himself of that opportunity to copy some of the works of the great masters, and to pursue the acquisi-

tion of his art under the direction of his own taste and judgment. His contemporary, GREUZE, whom the French reckon their most eminent portrait-painter of that day, and who acquired besides great fame by his compositions from humble life, was likewise a self-taught artist. Having begun at a very early age, we are told, to cover the walls and furniture of the house with his sketches, he was strictly forbidden by his father to continue that amusement; but the bias of his genius was too strong for the paternal interdiction, and he was again and again found with his chalk or charcoal in his hand, and busy at his old employment. At last, one day, when his father had been scolding him on this account, a painter of the name of Grandon, from Lyons, happened to pay them a visit (they lived in the town of Tournus in Burgundy, at no great distance from that city); and it was agreed by all parties that young Greuze should be taken home by him to Lyons, and regularly instructed in the art to which he had shown so strong an attachment. It is affirmed, however, that he was already nearly as good a painter as the master to whom he was thus consigned, and that in his subsequent progress also he was chiefly his own instructor. Another artist of the same period, distinguished in a different line, GEORGE DIONYSIUS EHRET, whose admirable drawings of botanical objects are well known from the engravings in the *Hortus Cliffortianus* and other splendid works, was the son of a working gardener, employed in the gardens of one of the German princes, and, when a boy, acquired his skill in delineating flowers so entirely by his own efforts, and, it may be even added, with so little consciousness of the progress he was making, that he had formed a valuable collection of the productions of his pencil before he was aware that his labours were worth anything. Dr. Trew, a physician of Nuremberg, having accidentally heard of him, desired to see his drawings, and found that he had already executed

representations of about five hundred plants in a style of extraordinary excellence. These paintings had been merely the amusement of the young and self-taught artist; and his surprise may be conceived when Dr. Trew offered to purchase them from him for four thousand florins, or above two hundred and fifty pounds sterling. Even the money was not so welcome as the assurance thus given him of the value of a talent which he had hitherto rated so lightly. Ehret, who from this moment determined upon making botanical drawing his profession, eventually, as we have said, earned the highest distinction in this line of art—especially after the intimate acquaintance he formed with the celebrated Linnæus, who directed his attention to the importance of minute fidelity in delineating some of the details of vegetable nature, which he had been accustomed too much to overlook. After having resided in different parts of the Continent, he came to England in 1740, when he was about thirty years of age, and remained in this country till his death in 1770. He had educated himself diligently in other branches of literature and science, as well as in those immediately connected with his profession, and had been a Fellow of the Royal Society many years before his death.

To these instances we may add the strange and romantic story of the Italian painter, Antonio de Solario, commonly called Il Zingaro, or The Gypsy, to which, after it had been long almost forgotten, attention was recalled some years ago, in consequence of the discovery of one of the artist's paintings at Venice. On this painting, which was purchased from a dealer by the Abbate Louis Celotti of that city, Solario designates himself a Venetian; and the circumstance appears to have been received as a matter of no small gratification and triumph by those who now consider themselves as hence entitled to claim him as their countryman. A Signor Moschini has published a small

pamphlet* upon the subject, which he dedicates to the Abbate Celotti, and in which he details the particulars of Solario's history, as they are given in Bernardo Dominici's 'Lives of the Neapolitan Painters,' one of the few writers by whom even his name had heretofore been noticed. Dominici, however, represents him as having been a native of the province of Abruzzo, in Naples; and Moschini therefore addresses himself, in the first place, to refute this error, as he conceives it to be, and to maintain the claim of Venice to the honour of having been the Gypsy's birth-place. His argument upon this point, though rather long, issues, after all, merely in a reference to the inscription upon the Abbate Celotti's picture, which, in the absence of all other direct evidence, he contends ought to settle the question. But, wherever he may have been born, it is agreed on all hands, that Solario was originally a Gypsy, or wandering tinker, and that it was in this character he first made his appearance at Naples in the beginning of the fifteenth century. He was, at this time, in the twenty-seventh year of his age, having been born, it is said, although about this date there is some doubt, in the year 1382. While here, he chanced to be employed to do some work in the way of his craft by a painter of the name of Colantonio del Fiore. This painter had a very beautiful daughter; the young lady was seen by Solario; and the tinker at once fell deeply in love with her. It was taking a bold step, certainly, and one not very likely to be successful; but, impelled by his passion, the enamoured Solario determined to ask the lady from her father in marriage. His application was treated with ridicule by Colantonio; who, by way of effectually extinguishing the poor Gypsy's hopes, told him that he meant to bestow his daughter only upon some one who was as good a painter as himself. "Then will you

* Memorie della Vita di Antonio de Solario, detto il Zingaro Pittore Veniziano. Venezia, 1828.

accept of me," said Solario, "for your son-in-law, if after a certain time I shall present myself to you with that qualification? Will you give me ten years to learn to paint, and so to entitle myself to the hand of your daughter?" Colantonio thought that he would not hazard much by assenting to this proposal, by which he would at least rid himself for the present, and for a considerable time to come, of his importunate suitor, whose pertinacity and earnestness began somewhat to alarm him; and so, not greatly apprehending that he should ever hear more of him, he assured the tinker, that, if he came back within the period in question transformed into a painter, the young lady should be his. Before this, the story relates, Solario had, by some means or other, obtained the attention and favour of the King's sister; and he now insisted that Colantonio should go with him to that princess, and, in her presence, renew his covenant. Somewhat more favourably impressed towards his proposed son-in-law, probably, by being made aware of the interest he had at court, the painter agreed to this also; and the princess accordingly became the witness of the solemn ratification of his engagement. Having settled the matter thus far, Solario immediately left Naples, for Colantonio had stipulated that he should remove to a distance while acquiring his new accomplishment; and in the first instance he proceeded directly to Rome. Here, how ever, he could not find an instructor to his mind; but he heard much talk of Lippo Dalmasi, who resided at Bologna, and thither therefore he determined to betake himself. On finding Lippo, and telling him his object, he received at first from that person only an urgent exhortation to think no more of so wild a plan, and to trust to the efficacy of time and absence to cure his passion; but Solario continued to press his application so perseveringly, employing even tears to aid his entreaties, that the reluctant painter was at last prevailed

upon to admit him as his pupil. To the ardent Solario it now seemed as if all his difficulties were over. From the moment in which he began to receive Lippo's instructions his application was unceasing. Awkward as he was at first, he soon became the admiration and envy of his fellow-students; and even his master himself now advised him to persevere in his new career, as earnestly as he had formerly endeavoured to dissuade him from entering upon it. He remained six or seven years with Lippo, and then left Bologna to visit the other principal towns of Italy, with the view of improving himself in his art by studying the various styles of other painters. In this peregrination he spent nearly three years, during which he visited, among other places, Florence, Ferrara, and Venice: and then, returning once more to Naples, after an absence of nine years and some months, he first presented himself to one of the gentlemen attached to the court, whose picture he drew, and by his means was introduced to the presence of his old friend, the princess, who had by this time ascended the throne.* Changed as he was in outward appearance, as in everything else, he was not recognised by his former patroness; but a Madonna and Child, of his own drawing, which he offered to her, was graciously accepted. When her majesty had expressed her approbation of this picture, the painter threw himself at her feet, and ventured to ask her if she did not recollect the wandering gypsy, who ten years before had had the honour of being admitted to her presence, and in whose fortune she had then been pleased to take an interest? After recognising him, the queen, at first, would scarcely believe that he had really painted the picture he had given her; but, on his executing in her presence a portrait of herself, she no longer doubted his pretensions. She then sent for Colantonio, and, having submitted the pictures

* This must have been Joan II., who reigned at Naples from 1414 to 1435.

to his inspection, desired him to tell her what he thought of them. Colantonio extolled them both to the skies. On this her majesty asked him whether he would not rather give his daughter to the artist whose productions were now before him, than wait any longer for the return of the gypsy, of whom he had heard nothing for so many years? Too glad of such an opportunity of escaping from his engagement, the Neapolitan painter eagerly expressed his assent to this proposal; when her majesty, calling to Solario to step forward from his place of concealment behind a curtain, where he had heard all that passed, at once solved the mystery. We need scarcely add the conclusion of the story. Solario received his well-earned bride; the father, as he put her hand in his, remarking that, if not his ancestry, at least his art deserved her. Solario was soon after this appointed painter to the Neapolitan Court. During the remainder of his life he executed many works, which placed him in the very first rank of the painters of that age. In particular his series of pictures in *fresco*, illustrative of the life of St. Benedict, in the church of the convent of St. Severinus, at Naples, long excited universal admiration; and, even in the half-defaced state in which they at present exist, testify the extraordinary powers of the artist. These frescos, however, he left unfinished at his death, in 1455. The picture by Solario, which the Abbate Celotti has lately recovered, and of which an engraving is given in Signor Moschini's pamphlet, is considered as fully sustaining the artist's traditionary fame. As for the history which we have just detailed, it is not improbably indebted to the popular love of the marvellous for some portion of the shape in which it has come down to us; but there can be little doubt that it is, in the main, founded upon fact. The reader will remark its similarity to that of Matsys, the Flemish painter;* and, if both relations be true,

* Vol. i. p. 62.

seldom, certainly, has love had to boast of a greater or worthier triumph than those it achieved in the cases of the Italian tinker and the blacksmith of Antwerp.

But we should never come to an end if we were to seek to notice all the histories of the subjugation of outward circumstances, by the enthusiasm and strong determination of genius, which the biography of painters would supply. We will add one name from a kindred department of art—that of the great sculptor CANOVA. He was also, in great part, a self-taught artist. Canova was born in 1757, at a small village situated in the Venetian territory. His father was a stone-cutter, and died when Antonio, who was his only child, was in his third year. His mother, in a few months, married again, and, removing to another village, left the child, who was of a very delicate frame of body, with his paternal grandfather and grandmother. This turned out by no means the most unfortunate thing that could have happened to Antonio; for his grandfather, whose name was Pasino, although only a stone-cutter too, was a man of remarkable intelligence and ingenuity, and, by all accounts, much better qualified at least to kindle to its first love of art the genius of the future sculptor than his own father, had he lived, would probably have been. Pasino's wife, Catherina, too, took the most tender care of her little grandson. He was, indeed, the delight of the good old people; and, while he was yet almost a child, Pasino, who, as we have just said, was accomplished much beyond the generality of his class, had taught him the elements of drawing, and had even set him to model in clay, and to shape little fragments of marble into the figures of the more simple and easy inanimate objects. The young artist, on his part, had no delight anywhere but in his grandfather's workshop, unless it was, after the hours of labour, to listen to the tales and ballads recited to him by his grandmother. So early as his ninth year, indeed, Pasino employed him as a regular

workman, and he continued to work as such till he was twelve. During these three years he had been wont occasionally to accompany his grandfather to execute repairs at the houses of the neighbouring proprietors, several of whom were Venetian noblemen, who had their country residences in this district. Among them was the Signor Giovanni Falieri, a gentleman of cultivated taste, who, after having frequently seen the boy, was so much pleased with his manners, as well as with the evidences of ingenuity which he already displayed, that he at last resolved to take him into his house, in order that he might enjoy some of those advantages of education which his grandfather's humble means could not afford him. A story has been told of Canova having first attracted the attention of the Falieri family by his having on one occasion, when some ornament was unexpectedly wanted for the Signora's table, modelled for the purpose a lion in butter, which excited such admiration that the artist was immediately inquired after, and orders given that he should be brought forward. But it appears certain that this anecdote is a fable, in so far at least as the introduction of the sculptor to his early patron is attributed to the circumstance in question. Pasino had been long known to Signor Falieri, who had also had many occasions of remarking the promising talents of his grandson before he took him into his house.* That step, however, he appears to have adopted with no higher views, at first, than merely that the boy's general faculties might receive such cultivation as should enable him to follow the trade of his father and grandfather with superior advantages. Nor did he probably entertain any other intentions with regard to the future destination of his *protégé*, when, after some time, he sent him to receive some instructions in the rudiments of sculpture from an artist of consider-

* *Vide* 'Memoirs of Antonio Canova,' by J. S. Memes, A.M Edin. 1825, pp. 153, &c.

able eminence who then happened to be residing in the neighbourhood, Giuseppe Bernardi, or Toretto, as he was otherwise called. In Toretto's workshop, however, Canova soon learned much more than it had been intended he should acquire. After he had been there somewhat above a year, he one day took an opportunity, in his master's absence, to make models of two angels in clay. When Toretto, on his return home, saw these figures, he could scarcely believe that they had been executed by his pupil, who had hitherto, in fact, received lessons merely in some of the mechanical processes of the art. Canova remained with Toretto about three years, and then returned to his native village and his original occupation. But, fortunately, Signor Falieri, who now resided in Venice, seized probably by some misgivings as to the fitness of the humble sphere to which he had consigned the talents of his young friend, after a short time again sent him an invitation to come to him. To Venice, accordingly, Canova repaired, being now in his sixteenth year. From this date it may be considered to have been fixed that he should become an artist. He therefore applied himself assiduously to all the necessary studies. In order, at the same time, that he might not be entirely dependent on his patron, although he lived in his palace, he formed an engagement to give his services during the afternoon to a sculptor in the city, from whom, however, he got very little for his work. "I laboured," says he, in one of his letters,* "for a mere pittance, but it was sufficient. It was the fruit of my own resolution; and, as I then flattered myself, the foretaste of more honourable rewards,—for I never thought of wealth." His day, therefore, was thus divided :—the morning was given to study in the academy or the galleries, the afternoon was spent in the workshop, and the evening was devoted to the improvement of his mind in general knowledge.

* 'Memoirs,' by Memes, p. 188.

The first commission which Canova ever obtained was from a Venetian nobleman, for two baskets containing fruits and flowers. This, his earliest performance, is still to be seen at Venice: but it is not thought to give much promise of the excellence which he afterwards attained. He next proceeded to the execution of a group on the subject of Orpheus and Eurydice for Signor Falieri; but this he did not finish till many years afterwards. Meantime he determined to set up in business for himself; and his first workshop was a small ground cell in the Monastery of the Augustine Friars, the use of which he obtained by a grant from the brotherhood. In this humble and obscure apartment Canova wrought for four years. But, although not much noticed by the world during this period, his mind was all the while making rapid progress in the study and mastery of his art. It was at this time that, left entirely in the pursuit of excellence to the guidance of his own reflections, he first began to perceive the necessity of founding the study of art upon the study of nature, in opposition to the notion which then prevailed that certain assumed principles and rules of operation were alone to be attended to. As soon as this new view dawned upon his mind he hastened to regulate his studies in conformity to it. Instead of merely examining and copying the works of other sculptors, he resorted for every part of his art to the works of nature. He studied anatomy. He attended the public spectacles and the theatres, that he might catch the finest attitudes of the human figure from the living exhibition. In walking the streets, in like manner, his eye was constantly on the watch to catch new forms of grace and power from the moving life around him. His art now became more than ever the sole object for which he lived. He laid down a rule for himself, which he strictly observed, never to pass a day without making some progress, or to retire to rest till he had produced some

design. In the meantime he also pursued with ardour his studies in general knowledge, especially in those branches which he conceived to be most important to him in his profession, such as poetry, antiquities, history, and the Greek and Roman classics, which, however, he could only read through the medium of translations. He likewise studied the French and Spanish languages. All this time, however, as we have mentioned, he was very little known. The first performance by which he attracted the notice of his fellow-citizens was his finished group of Orpheus and Eurydice, which he exhibited in 1776. Immediately after this orders began to flow in upon him, and he soon removed to a better workshop. In 1780 the Venetian senate bestowed upon him a pension of 300 ducats (about 60*l.*), in order that he might have it in his power to go to finish his studies at Rome. From this time the ecclesiastical capital became his chief residence. On his first arrival there, however, his novel principles of art revolted all the established authorities in such matters; and for a long time his works were the ridicule both of connoisseurs and of his brother sculptors. It was not till about the year 1800 that Canova's merits were fully and generally recognised. From this time, however, till his death, in 1822, he stood in universal estimation in the first rank of his art, and received all the honours that the admiration of the world could bestow upon him, as one of the greatest sculptors that had appeared in modern times.

The last person we shall mention under this head is our countryman, THOMAS BEWICK, so deservedly celebrated for his admirable performances in wood-engraving, an art of which he may be said to have been not so much the improver as the reviver or re-inventor. Bewick was born in the year 1753, at a village called Cherryburn, in Northumberland. From his earliest years he delighted above all things in observing the habits of animals; and it was his fondness for this study

that gave rise, while he was yet a boy, to his first attempts in drawing. Long before he had ever received any instruction in that art, he used to delineate his favourites of the lower creation with great accuracy and spirit. His introduction to the regular study of his future profession was occasioned by an accident similar to that which has been mentioned a few pages back as having happened in the case of the French painter Greuze. Bewick also was in the habit of exercising his genius by covering the walls and doors of the houses in his native village with his sketches in chalk. Some of these performances one day chanced to attract the attention of a Mr. Bielby, a copper-plate engraver of Newcastle, as he was passing through Cherryburn; and he was so much struck, it is said, with the talent they displayed, that he immediately sought out the young artist, and obtained his father's consent to take him with him to be his apprentice. Mr. Bielby had not had his young pupil long under his charge, when Dr. Hutton, of Woolwich, happened to apply to him to furnish a set of copper-plate engravings for a mathematical work (his 'Treatise on Navigation') which he was then preparing for the press. Bielby, however, who was a very intelligent man, suggested to the Doctor that, instead of having his diagrams engraved on copper, in which case they could only be given on separate plates, to be stitched into the volume, it would be much better to have them cut in wood, when they might be printed along with the letter-press, each on the same page with the matter which it referred to, or was intended to illustrate. This is one of the chief advantages of wood-engraving. In a copper-plate, as may be known to most of our readers, the parts which are intended to leave an impression upon the paper are cut into the copper, so that, after the ink is spread over the engraving, it has to be rubbed from all the prominent or uncut portion of the surface, in order that it may remain only in these

hollows. The consequence is that, in the first place, the plate is very soon worn, or the fineness of the lines impaired, by the continual abrasion to which it is subjected; an inconvenience, however, which has been greatly reduced by the modern substitution of steel for copper. Secondly, from the method of inking being so different from that which is used in printing letter-press, where the parts of the type that make the impression are the prominences and not the hollows, and the ink, therefore, is allowed to remain where it naturally adheres on being applied by the ball or roller, the copper-plate engraving must always be printed by itself, and generally on a separate page from the letter-press. The only way of giving both on the same page is to subject the paper to two successive impressions, which, beside the inconvenience of the operation, almost always produces an unpleasant effect from the difference of colour in the two inkings, and the difficulty of adjustment. A wood-cut has none of these disadvantages. As the impression is to be made by the prominent parts of the wood, these, which receive the ink directly from the roller, are allowed to retain it, just as in the case of ordinary types; and there is therefore nothing of that process of rubbing at every impression, which so soon wears out a copper-plate. The consequence is, that, while rarely more than two thousand impressions can be taken from a copper-engraving before it requires to be retouched, a wood-cut will yield perhaps fifty thousand. Then the latter, from the manner in which it is to be inked, admits of being set up, if necessary, just like any of the other types, in the midst of a common page, and so of being printed both in the most convenient place, and without any separate process. The block must, of course, for this purpose be made very exactly of the same thickness or depth as the other types along with which it is placed. In the early days of wood-engraving the pear-tree or apple-tree was the wood most

commonly used; but box-wood is now generally employed, as being of a still firmer and more compact grain. The surface of the block is first shaved very even and smooth; and upon this the figure is then traced in pencilling as it is to be finally cut out in relief.

Dr. Hutton followed Bielby's advice with regard to the diagrams for his book, and it was arranged that they should be cut in wood. Many of them, accordingly, were put by his master into young Bewick's hands. The boy executed them with so much accuracy, and a finish so greatly beyond what had usually been attained in that species of work, that Mr. Bielby earnestly advised him to give his chief attention henceforward to wood-engraving, and to make it his profession. At this time that art had fallen into the lowest repute. Yet it had by no means been always so. In former times it had both counted several distinguished names among its cultivators, and had reached a very striking degree of effect in some of its productions. About the end of the fifteenth century, the celebrated painter Albert Dürer, who was also eminent as a copper-plate engraver, practised cutting in wood. When the art was first introduced it was employed chiefly to furnish ornamental borders for the title-pages of books; and these decorations were in general merely broad stripes of black, enlivened by a few simple figures, such as circles or hearts, which were left white upon a dark ground, by being, not raised, but scooped out in the wood. In the same manner, when any object, the shape of a human or of any other being, for instance, was to be represented, it was the practice merely to cut away the block according to the requisite outline, leaving all the space within untouched, so that when inked and applied to the paper, it left its impression in a blot of unrelieved and uniform blackness throughout: the picture of the devil, in particular, used often to be

exhibited in this sable, and as many no doubt deemed it in that case, peculiarly suitable, guise. It soon, however, became usual to introduce white lines, effected, of course, by the easy process of merely cutting grooves in the wood, to mark the shades at the knees, shoulders, and other parts of the figure; an improvement which made the representation both less sombre and also somewhat more natural. At a still later period the outline alone and the shaded parts were left prominent. This may be considered to have been the commencement of the existing style of the art. But the period during which wood-engraving was carried to the greatest perfection was about the end of the fifteenth century, when a method was followed by some of the more eminent artists, which gave to their performances an effect unattained by their predecessors, and which the best productions of succeeding times have perhaps scarcely surpassed. This was the method of cross-hatching, or cutting the wood into a congeries of squares or lozenges by two series of prominent lines running transversely to each other. By this means they produced not only shading, but gradations of shading, with as much perfection as is done in copper-plate engraving; for the different parts of the picture had only to be hatched more or less closely, according as they were intended to be dark or light. Many of Albert Dürer's performances are distinguished by this peculiarity. The difficulty, however, of carving these crossing lines upon the wood must have been exceedingly great; and indeed it has been supposed by some that the effect in question was produced by the paper being impressed, not upon one, but upon two blocks successively. The method of cross-hatching in wood has, at all events, been long abandoned; although some attempts that have been made in very recent times have shown that it is perfectly practicable to produce the same effect as in the works of the old masters by a single block, although at the

expense of extraordinary labour and skill. If the old method had consisted in any such half-mechanical process as the application of successive blocks, it probably would not have fallen so completely into oblivion. It was no doubt the extraordinary pains it cost and the time it consumed that occasioned its disuse.

When the practice of cross-hatching was abandoned, however, wood-engraving may be said to have ceased to be cultivated as an art. In this country in particular it was seldom resorted to except to furnish a few of the simple ornaments used in common printing, such as a border for the title-page, a tail-piece, or a coarse cut to put at the head of a street ballad. From this state of contempt it was raised again to the rank of one of the fine arts, by the genius and perseverance of the individual the mention of whose name has given occasion to this brief sketch of its history, and who, by his labours in its cultivation and improvement, raised himself also from obscurity to distinction. According to Mr. Bielby's advice, Bewick probably continued to give much of his attention to cutting in wood during the remainder of his apprenticeship. As soon as it was over he repaired to London, where he went into the employment of a person who practised this trade, such as it then existed, somewhere in the neighbourhood of Hatton Garden. It is probable, however, that he soon found he was not likely to learn much from his new master; for, in a very short time, he returned to the country. With his taste, too, for rural scenery and enjoyments, and the observation of nature, he found little in London in which he took much interest. When Mr. Bielby, therefore, now offered to take him into partnership, he at once resolved to retrace his steps to Newcastle. Nor even after he had obtained his highest celebrity did he ever again think of establishing himself in the metropolis. He spent the remainder of his life in his native district.

The first specimen of his talents by which Bewick

made himself known was a cut of an old hound, which, being laid before the Society of Arts, obtained a prize which they had that year offered for the best wood-engraving. This was in 1775. The block had been cut for an edition of Gay's 'Fables,' which had been projected some time before by Mr. Thomas Saint, the printer of the 'Newcastle Courant.' The work itself appeared in 1779, and immediately attracted general attention by the striking superiority of its embellishments, which were all from wood-cuts executed by Bewick and his younger brother John, who, when Bielby and he entered into partnership, had become their apprentice. From this time the reputation of the artist went on increasing steadily, and he produced a succession of works which very soon gave altogether a new character to his art itself.

The work, however, which established his fame was his 'History of Quadrupeds,' which appeared in 1790. He had been employed many years in preparing this publication, all the cuts in which were not only engraved by himself or his brother, but were all copied from his own drawings; for he had continued to cultivate his early talent for the delineation of animals with unwearied industry, having been in the habit of taking sketches of all the striking specimens that came under his notice; while, in order to obtain accurate representations of those of greater rarity, he never failed to visit whatever menageries came to Newcastle, and there to draw them from the life. His assiduous studies from Nature no doubt greatly contributed to the excellence of the cuts in the 'History of Quadrupeds.' Many of the vignettes, also, with which this publication was adorned had uncommon merit as original sketches; for Bewick did not confine his attempts with his pencil to the mere delineation of animals.

But he was principally indebted for the great superiority of his productions over those of his predecessors

to an entirely new mode of operation, which he introduced into the art. The secret of the old method of cross-hatching, as we have mentioned, had been long lost, or, at least, it had been entirely abandoned from the extraordinary difficulty of the only known manner of practising it. But Bewick produced nearly the same effects by another and much simpler contrivance. Till his time, the block, when prepared for the press, presented only two varieties of surface; the parts which were intended to receive the ink and make the impression being left in relief, while all the rest of the wood was cut away to so great a depth as entirely to prevent it from touching the paper. The consequence was, that the dark portions of the engraving were all of one shade, while the only other colour introduced was the pure white of the paper. But Bewick secured a variety of tints, and thereby a much truer and more natural perspective, by leaving certain parts of his blocks not quite so prominent as those that were intended to produce the darkest lines, while at the same time he did not lower them so much as altogether to prevent them from coming in contact with the paper when applied to take off the cut. The portions of the surface which were left in this state communicated an impression varying in depth of shade according to the degree in which the wood was scooped away; and the cut thus exhibited upon the paper all the gradations to be found in a copper-plate engraving. It is said that this improvement was first suggested to Bewick by his friend, the late Mr. W. Bulmer (afterwards the eminent London printer), who was a native of Northumberland as well as himself, and, serving his apprenticeship in Newcastle at the same time, used always to take off the proofs of Bewick's cuts. To the skill and contrivance of the artist himself, however, we are doubtless to ascribe the first application and practical demonstration of the new method, as well as the subsequent improvements by which he eventually

gave to it probably all the perfection of which it is susceptible.

It would be out of place in a sketch like this to follow up what has been said by a catalogue of the various works which Mr. Bewick gave to the world after the period in his history at which we are now arrived, or which made their appearance illustrated by his embellishments. We have traced the steps by which he rose, through the force of his own talents and industry, to the head of his profession; and it is not necessary that we should pursue his career farther. Suffice it to say, that he amply sustained throughout the remainder of his long life the promise of his early progress. No man was ever more devoted to his profession. Its labours were as much his enjoyment as his business. He was always an early riser; and from the hour at which he got out of bed till evening he was generally to be found at work, and whistling merrily all the while. For what are called the pleasures of society he cared very little; his social hours were passed in the midst of his family, or occasionally among a small number of select friends when the task of the day was done. Everything in the least degree savouring of effeminate indulgence he despised. His ordinary exercise was walking; but he was fond of all the manly and invigorating sports of the country, and desired no better relaxation from the toils of the workshop than an occasional participation in such cheap and simple amusements. The whole economy of his life was regulated upon a principle of rigid temperance, as well as of the most steady and persevering exertion. He was remarkable at all times for the moderation with which he ate and drank; and in respect to other matters he showed such a contempt for luxury, that he generally slept, even in the depth of winter, with the windows of his chamber open, though in consequence he sometimes, on awaking, found the snow lying on his bed-clothes. For money, which men in general

prize so highly, Bewick had all the indifference of a philosopher. The number of works which his unwearied application produced was, as might be expected, extraordinarily great. But he did not confine his studies and performances merely to the art in which he has chiefly earned his fame. He made himself competently acquainted with various branches of knowledge; and with natural history in particular he was intimately conversant. He also engraved occasionally on copper as well as on wood. Even the greater leisure which he was obliged to allow himself during the few last years of his life, when the infirmities of old age compelled him partially to relinquish his professional labours, was not given up to mere idleness. He availed himself of this release from his ordinary occupations to write a memoir of his own life, which is said to be composed with much minuteness of detail, and to be of considerable extent.* But to the very last hour of his existence his art continued to occupy his thoughts. His last undertaking—directed, like most of those by which it had been preceded, mainly by an anxiety for the diffusion of sound knowledge and morality—was the preparation of a series of cuts for the labouring part of the population, which might supplant the tasteless and sometimes corrupting prints usually found among the embellishments of the cottage; and a proof impression of the first of this intended collection, a cut of an old horse, heading an address against cruelty to animals, was brought to him only two or three days before his death. This eminent artist and excellent man died on the 8th of November, 1828, in the 76th year of his age.

* In the account of Bewick in vol. xiv. of the *Annual Biography*, to which we have been principally indebted for the materials of this sketch.

CHAPTER XI.

USEFULNESS OF SUCH ENCOURAGEMENTS AS THE EXAMPLES HERE GIVEN ARE CALCULATED TO AFFORD TO YOUTHFUL GENIUS IN EVERY DEPARTMENT OF STUDY.—SELF-EDUCATED POETS:—JOHN TAYLOR; ANTONIO BIANCHI; RAMSAY; BLOOMFIELD.

THE individuals with whom our three last chapters have been occupied have not earned their distinction by the cultivation of any branch of what is properly called science or literature; but their lives do not on that account furnish us with less suitable illustrations of the subject of the present work. Our object is to inculcate the importance, to demonstrate the practicability, and to point out the method, of intellectual improvement generally; and especially to make the young reader understand and feel, by an array of examples taken from every condition of society and every walk of mental exertion, that, in the pursuit of any description of knowledge, no difficulties arising from external circumstances can eventually resist a steady determination to excel; so that a man's success or failure in such an attempt depends, in fact, more upon himself than upon any circumstances in which he may be placed. We have not, therefore, hesitated to bring forward any case of extraordinary attainments made in despite of such obstacles as usually repress all endeavour after intellectual cultivation, whether it might be that of an individual who had distinguished himself in philosophy, in scholarship, or in art. What we have wished to establish and make evident is, the power which every man really desirous of education has, in the absence of all aid from others, to educate himself; and that this power is not confined to the case of any particular sort

of acquirement, but exists in nearly an equal degree in regard to every species of knowledge or skill which any one may be ambitious to acquire. And a moment's consideration will show the vast importance of such a truth being generally diffused and felt in all its universality. How much apprehension and despondency would even those of the children of poverty and neglect who have been eventually most successful in their efforts to educate themselves been saved from, had they all possessed such an assurance as these examples are calculated to afford, that many others had triumphed in the same or a harder struggle before them! Would not this of itself have helped to smooth the roughest of their difficulties, and carried them forward on their way with new strength, even when their hearts were most ready to fail them? Might not such an assurance have led many to high attainments, and perhaps to achievements beneficial to themselves and to mankind, in some one of the various paths of intellectual enterprise, who, frightened by the apprehended arduousness of the task, have either never made an attempt to emancipate themselves from the ignorance in which they were reared, or, having begun the pursuit of knowledge, have stopped in their career ere they had made any considerable progress? Nor let it be said that the mere force of talent, where it really exists, will of itself be sufficient to overcome everything that may tend to repress it. Even genius of the highest order is often diffident, and easily dismayed; its quickness of sensibility makes it apprehensive, and prone both to exaggerate difficulties where they exist, and to create them where they do not. On these accounts it frequently needs encouragement where a coarser nature, and faculties of immeasurably less real power, might safely be left to make their way without any pains being taken to invigorate or sustain their possessor's confidence of success. We cannot then doubt the usefulness of

diversifying our illustrations as much as possible by selecting them from all the different departments of biography. We would offer to every aspirant, in every line of intellectual pursuit, an example by which he may at least learn that he is setting out upon no impracticable or hitherto unaccomplished journey, but that a road as difficult as his own, if not the very same, has been travelled by another before him. Whether it be literature, or science, or any branch of art, in which it is his desire to accomplish himself, let him be as destitute at the commencement of his career of all the ordinary means of instruction as he may, we would endeavour by the variety of our examples to strengthen him with the assurance that the way is still open for him, not only to mediocrity of attainment in his chosen pursuit, but even, it may be, to the highest distinction.

We propose now to notice a few of the more remarkable instances, not already adverted to, in which a genius for another of the fine arts, Poetry, which is, however, at the same time, a department of literature also, has burst through all the impediments of an unfavourable worldly lot, and prompted its possessor to the successful pursuit of that education which here, as everywhere else, can alone enable even the most extraordinary native powers of mind to produce anything of much value. For it is certainly a very unfounded, though by no means an uncommon notion, that the case of poetic talent forms an exception to this general rule, and that to be a great poet a man has *only* to be born such. There is no instance on record of an individual either securing or deserving any considerable or permanent distinction by his poetical productions, who had not stored his mind with much and various knowledge, —in other words, who had not educated himself well, although never, it may be, matriculated in any university. The germ of a genius for poetry has no doubt sometimes made its appearance in individuals nearly altogether

uneducated; but where is to be found the case of this description in which the seed, so buried in an uncultivated soil, has ever grown to anything worth the gathering? It is indeed very much to be apprehended that this mistaken notion in regard to the uselessness of education to a poet, which is sometimes carried so far as to amount to a belief that a poet is actually spoiled by being educated, has not unfrequently had the effect of preventing persons who felt, or supposed, themselves to be gifted with poetic powers, from exerting themselves with so much ardour and perseverance as they otherwise might have done in the general cultivation of their faculties, or even, in some cases, from making any such attempt at all. Some poets of the humbler class, at any rate, might probably be mentioned, who would have written better if they had taken more pains to add other acquirements to their talent for versifying. We had in this country, in the seventeenth century, a famous popular writer, named JOHN TAYLOR, but who was generally called the Water Poet, from the occupation by which he won his livelihood, which was that of a waterman on the Thames. Taylor, whose parents were poor people, had learned a very little Latin at a school in the city of Gloucester, where he was born; but this, which was in truth merely a few pages of the rudiments very imperfectly conned, he soon forgot, and he never attempted to recover it. Yet he showed considerable industry in tagging rhymes, both while engaged in the laborious employment we have mentioned, and at an after period, when he kept a victualling-house at Oxford. During the civil wars he published a great many effusions on the royalist side, some of which show considerable powers of humour, and give ground for believing that, with more study and a larger acquaintance with literature, the author would have produced compositions of much greater value. The mention of Taylor reminds us of another water-poet, ANTONIO

BIANCHI, a common Venetian gondolier, whose epic, entitled 'David, King of Israel,' in twelve cantos, made its appearance at Venice about the middle of the last century. From the accounts, however, given of this poem, which is written in the Venetian dialect, it appears to be, notwithstanding the provincial and unclassical character of the language, a work of a very superior order to anything that the English waterman ever produced, both in genius and in the evidence which it affords of the author's reading and information. Bianchi afterwards published a critical tract, which was deemed to display considerable ability. But an acquaintance even with the most classic poetical productions of their country is, or was, far from uncommon among the Venetian gondoliers. Sir J. Cam Hobhouse, in the notes to the fourth canto of 'Childe Harold's Pilgrimage,' tells us that many portions of Tasso's 'Jerusalem' used to be familiar to most of them, and that editions of the entire poem, translated into the Venetian dialect, were formerly in general circulation. On one occasion, in January, 1817, he mentions that he himself, accompanied by Lord Byron and another Englishman, went to an island a short way from the city in a boat rowed by two men, one of whom was a carpenter and the other a gondolier, the former of whom placed himself at the prow, the latter at the stern. "A little after leaving the quay of the Piazetta," continues the account, "they began to sing, and continued their exercise until we arrived at the island. They gave us, among other essays, the death of Clorinda, and the palace of Armida; and did not sing the Venetian, but the Tuscan verses. The carpenter, however, who was the cleverer of the two, and was frequently obliged to prompt his companion, told us that he could *translate* the original. He added, that he could sing almost three hundred stanzas, but had not spirits (*morbin* was the word he used) to learn any more, or to sing what he

already knew: a man must have idle time on his hands to acquire or to repeat, and, said the poor fellow, 'Look at my clothes and at me; I am starving.'" Bianchi, we ought to add, was also the author of a second poem, of considerable extent, entitled 'Solomon, or The Temple,' as well as of several minor productions.

In our own country we have had many writers of verse who have arisen among the ranks of the labouring population, but, with the exception of Burns, no great poet. Perhaps the name that should be placed next to that of Burns is that of his countryman, ALLAN RAMSAY, the author of the 'Gentle Shepherd,' certainly one of the most natural, if not most poetical, pastorals to be found in any language. Ramsay was the son of one of the common workmen in the lead-mines belonging to the Earl of Hopetoun, in the south of Scotland; and, as soon as his strength permitted, he was himself employed in the mines as a washer of ore. What education he had he must have obtained at the village school, and it probably extended little beyond the elements of reading and writing. Having come to Edinburgh about the year 1700, when he was fifteen years of age, he entered upon his apprenticeship to a barber; and this profession he afterwards exercised in that city for many years. Like John Folcz, of Nuremberg, who was mentioned in our first volume,* and the still more famous Burchiello, of Florence, whose sonnets, written in the fifteenth century, are still admired in Italy for the purity of their style, Ramsay did not find the business he had chosen so unfavourable as might be supposed to intellectual cultivation. During the day he had abundant opportunities for thought in his sedentary occupation of making wigs; and he used to spend the leisure of his evenings in composing songs and other short poetical pieces in his native dialect, with no higher aim at first than that of adding to the entertainment of the social

* Vol. i. p. 51.

parties in which he was wont occasionally to mix. These compositions, however, were often written with so much spirit, that, in a short time, they brought the author into general notice, and, humble as his condition was, he began to be sought after by the most distinguished wits of the northern capital. The connexions which he thus formed enabled him at length to escape from his original trade; and he commenced business in the more appropriate vocation of a bookseller. After this Ramsay wrote and edited various works, and took his rank in all respects as one of the literary characters of the day. He lived till the year 1758, when he died at the age of seventy-three. The fancy of this poet is not very brilliant, but he had the art of writing his native Doric mellifluously, and his humour, though sometimes coarse, has a genial vigour about it which is very effective. In many of his effusions, too, and especially in his principal work, 'The Gentle Shepherd,' there is a natural simplicity and faithfulness of delineation, which all hearts, even the least poetical, are sure to feel and appreciate. These qualities accordingly have secured to him a popularity which, instead of having suffered diminution with the lapse of years, is probably greater now than it was in his life-time; for his writings, it is likely, were then scarcely, if at all, known out of Scotland, whereas his Pastoral is now familiar, by reputation at least, to many English readers. As the immediate predecessor of Ferguson and Burns, Ramsay has every claim to be considered the father of modern Scottish poetry.

One of the most respectable names among the humbly born and self-educated poets of the southern part of the island, is that of the late ROBERT BLOOMFIELD, the author of the 'Farmer's Boy.' Bloomfield was born in 1766, at a small village in Suffolk. His father, who was a tailor, died before the infant was a year old, leaving his widow with the charge of five other children besides

Robert. In these circumstances, in order to obtain a maintenance for herself and her family, she opened a school, and, of course, taught her own children the elements of reading along with those of her neighbours. The only school education which Robert ever received, in addition to what his mother gave him, was two or three months' instruction in writing at a school in the town of Ixworth. At the time when he was sent to this seminary he was in his seventh year; and he was taken away so soon in consequence of his mother marrying a second husband, who probably did not choose to be at any expense in educating the offspring of his predecessor, especially as his wife, in due time, brought him a family of his own.

We have no account of how the boy spent his time from his seventh to his eleventh year; but at this age he was taken into the service of a brother of his mother, a Mr. Austin, who was a respectable farmer, on the lands of the Duke of Grafton. His uncle treated him as he did his other servants, but that was kindly, and just as he treated his own sons. Robert, like all the rest of the household, laboured as hard as he was able; but, on the other hand, he was comfortably fed and lodged, although his board seems to have been all he received for his work. His mother undertook to provide him with the few clothes he needed; "and this," says his biographer, Mr. Capel Lofft, "was more than she well knew how to do." Indeed she found so much difficulty in fulfilling her engagement, that she at length wrote to two of her elder sons, who were employed in London as shoemakers, requesting them to assist her by trying to do something for their brother, who "was so small of his age," she added, "that Mr. Austin said he was not likely to be able to get his living by hard labour." To this application her son George wrote in reply, that if she would let Robert come to town he would teach him to make shoes, and his other brother,

Nat, would clothe him. The anxious and affectionate mother of the future poet assented to this proposal; but she could not be satisfied without accompanying her son to the metropolis, and putting him herself into his brother's hands. "She charged me," writes Mr. George Bloomfield, in giving an account of the incident, "as I valued a mother's blessing, to watch over him, to set good examples for him, and never to forget that he had lost his father."

When Bloomfield came to London he was in his fifteenth year. What acquaintance he had with books at this time is not stated, but it must have been extremely limited. We find no notice indeed of his having been in the habit of reading any at all while he was with Mr. Austin. Yet it would appear from the sequel of his brother's account that he had at least contrived to retain so much of what he had learned in his younger days as still to be able to read tolerably. The place in which the boy was received by his two brothers was a garret in a court in Bell Alley, Coleman Street, where they had two turn-up beds, and five of them worked together. "As we were all single men," says George, "lodgers at a shilling per week each, our beds were coarse, and all things far from being clean and snug, like what Robert had left at Sapiston. Robert was our man to fetch all things to hand. At noon he fetched our dinners from the cook's shop; and any one of our fellow-workmen that wanted to have anything fetched in would send him, and assist in his work, and teach him, for a recompense for his trouble. Every day when the boy from the public-house came for the pewter pots, and to hear what porter was wanted, he always brought the yesterday's newspaper. The reading of the paper we had been used to take by turns; but, after Robert came, he mostly read for us, because his time was of least value." The writer goes on to state that, in this his occupation of reader of the newspapers, Robert frequently met with

words which were new to him, and which he did not understand, a circumstance of which he often complained. So one day his brother, happening to see on a book-stall a small English dictionary, which had been very ill-used, bought it him for fourpence. This volume was to Robert a valuable treasure: and by consulting and studying it he soon learned to comprehend perfectly whatever he read. The pronunciation of some of the hard words, however, still puzzled him a good deal; but by a fortunate accident he was at length put in the way of having his difficulties here also considerably diminished. One Sunday evening, after a whole day's stroll in the country, he and his brother chanced to walk into a dissenting meeting-house in the Old Jewry, where a preacher of extraordinary abilities and great popularity was delivering a discourse. This was Mr. Fawcet, a collection of whose sermons has been printed, and used to be very popular. Fawcet's manner was highly rhetorical, and "his language," says Mr. George Bloomfield, "was just such as the *Rambler* is written in." Robert was so much struck by his oratory that, from this time, he made a point of regularly attending the chapel every Sunday evening. In addition to the higher improvement he derived from Mr. Fawcet's discourses, he learnt from him the proper accentuation of many difficult words which he had little chance of hearing pronounced elsewhere. He also accompanied his brother sometimes, but not often, to a debating society, which was then and for long afterwards, if it is not still, held at Coachmakers' Hall, and a few times to Covent Garden theatre. Besides the newspapers, too, he had at this time read aloud to his brothers and their fellow workmen several books of considerable extent—a 'History of England,' the 'British Traveller,' and a Geography, a sixpenny number of each of which, in folio, they took in every week. But these "he always read," says his brother, "as a task, or to oblige us who bought them." He calculates

that Robert spent in this way about as many hours every week in reading as boys generally do in play.

These studies, however, even although somewhat reluctantly applied to, doubtless had considerable effect in augmenting the boy's knowledge and otherwise enlarging his mind. But it was a work of a different description from any of those that have been mentioned which may be said to have first awakened his literary genius. "I at that time," continues Mr. George Bloomfield, "read the 'London Magazine;' and, in that work, about two sheets were set apart for a Review. Robert seemed always eager to read this Review. Here he could see what the literary men were doing, and learn how to judge of the merits of the works that came out. And I observed that he always looked at the 'poets' corner.' And one day he repeated a song which he composed to an old tune. I was much surprised that he should make so smooth verses; so I persuaded him to try whether the editor of our paper would give them a place in poets' corner. He succeeded, and they were printed." This is the way in which many a young literary aspirant has first tried his strength. Thus, as we have seen, the 'Ladies' Diary' was the repository of Thomas Simpson's earliest mathematical speculations; and it was in the columns of a Philadelphia newspaper that Franklin commenced his career as an author. A Bristol journal, in like manner, received the earliest antiquarian lucubrations of Chatterton, then only a boy of fifteen, while much about the same time the first of his Rowleian forgeries appeared in the 'Town and Country Magazine.'

After this Bloomfield contributed other pieces to the same publication into which his first verses had been admitted; and under the impulse of its newly-kindled ambition his mind would appear to have suddenly made a start forwards which could not escape the observation of his associates. "Indeed, at this time," says his

brother, "myself and fellow-workmen in the garret began to get instructions from him." Shortly after, upon removing to other lodgings, they found themselves in the same apartment with a singular character, a person named James Kay, a native of Dundee. "He was a middle-aged man," says Mr. George Bloomfield, "of a good understanding, and yet a furious Calvinist. He had many books, and some which he did not value; such as the 'Seasons,' 'Paradise Lost,' and some novels. These books he lent to Robert, who spent all his leisure hours in reading the 'Seasons,' which he was now capable of reading. I never heard him give so much praise to any book as to that."

It was the reading of the 'Seasons,' in all probability, which first inspired him with the thought of composing a long poem on rural subjects. The design was also in some degree favoured by a visit of two months which he was induced to pay about this time to his native district, in order to escape from the annoyance with which he was threatened, owing to a dispute that had taken place in the trade to which he belonged between those workmen who had and those who had not served a regular apprenticeship. As Bloomfield belonged to the latter class, the others, who had formed themselves into an association, talked of prosecuting his master for employing him; and he begged to be suffered to retire till the storm should blow over. On this occasion his old master, Mr. Austin, kindly invited him to make his house his home; and the opportunity he thus had of reviewing, with a more informed eye, the scenes in which he had spent his early years could hardly fail to act with a powerful effect in exciting his imagination. It was at last arranged that he should be taken as apprentice by his brother's landlord, who was a freeman of the city; and he returned to town. He was at this time eighteen years of age. It was not intended that his master should ever avail himself of the power which

the indentures gave him, and he behaved in regard to this matter very honourably. George, therefore, remained with his brother for about two years longer, by which time he had taught him to work as expertly as himself.

For some years after this, Robert's literary performances seem to have amounted merely to a few effusions in verse, which he used generally to transmit in letters to his brother, who had now gone to live at Bury St. Edmunds, in his native county. Meantime he studied music, and became a good player on the violin. In his twenty-fifth year he married, when "he told me in a letter," says his brother, "that he had sold his fiddle, and got a wife. Like most poor men, he got a wife first, and had to get household stuff afterward. It took him some time to get out of ready-furnished lodgings. At length, by hard working, &c., he acquired a bed of his own, and hired the room up one pair of stairs, at 14, Bell Alley, Coleman Street. The landlord kindly gave him leave to sit and work in the light garret, two pair of stairs higher."

The frequency of the development of literary talent among shoemakers has often been remarked. Their occupation, being a sedentary and comparatively noiseless one, may be considered as more favourable than some others to meditation; but, perhaps, its literary productiveness has arisen quite as much from the circumstance of its being a trade of comparatively light labour, and therefore resorted to in preference to most others by persons in humble life who are conscious of more mental talent than bodily strength. Partly for a similar reason, literary tailors have been numerous. We have already mentioned the Italian writer Gelli, our learned countrymen Hill and Wild, &c.; and to these we might add many others, as, for example George Ballard, author of 'Memoirs of Learned British Ladies,' who made himself a good Saxon scholar while practising his trade,—the antiquaries, Stow and Speed, who

both flourished in the sixteenth century, the former the author of 'The Survey of London,' and other very elaborate works, and the latter of a valuable History of Great Britain,—and the late celebrated French mathematician, Jean Henri Lambert, who, when young, after working all day with his father, who was a tailor, used often to spend the greater part of the night in reading, and in this manner, by the assistance of an old work which came by chance into his possession, instructed himself in the elements of mathematical science. Of literary shoemakers again, or persons who have contrived to make considerable progress in book-learning while exercising that handicraft, we have already noticed, among others, Benedict Baudouin, Anthony Purver, Joseph Pendrell, Gifford, and Holcroft. We may add to the list that extraordinary character Jacob Behmen, the German mystic, of whose works we have an English translation in two volumes quarto, and who continued a shoemaker all his life. But Bloomfield, before entering upon the exercise of this trade, had had the education of his faculties begun while following the equally contemplative and much more poetical occupation of a keeper of sheep—a condition, the leisure and rural enjoyment of which had fed the early genius of the painter Giotto, the logician Ramus, the mechanician Ferguson, the linguist Murray, and other lights of modern literature and art, as in the ancient world it is said to have done that of the poet Hesiod. Bloomfield's literary acquirements, however, with the exception of his acquaintance with the mere elements of reading and writing, appear to have been all made during the time he was learning the business of a shoemaker, and afterwards while he worked at the same business as a journeyman.

It was while he sat plying his trade in his garret in Bell Alley, with six or seven other workmen around him, that Bloomfield composed the poem which first

made his talents generally known, and for which principally he continues to be remembered, his 'Farmer's Boy.' It is a curious fact, that, notwithstanding the many elements of disturbance and interruption in the midst of which the author must in such a situation have had to proceed through his task, nearly the half of this poem was completed before he committed a line of it to paper. This is an instance of no common powers both of memory and of self-abstraction. But these faculties will generally exist in considerable strength when the mind feels a strong interest in its employment. They are faculties also which practice is of great use in strengthening. Bloomfield's feat on this occasion appears to have amounted to the composing and recollecting of nearly six hundred lines without the aid of any record; and the production of all this poetry, in the circumstances that have been mentioned, perhaps deserves to be accounted a still more wonderful achievement than its retention. Like his prototype, Thomson, whose general scheme he has followed, Bloomfield seems to have commenced his poem with the division relating to winter.

When the 'Farmer's Boy' was finished, which it appears to have been in April, 1798, it was submitted to several booksellers and other persons in London, none of whom, however, probably took the trouble of even examining the unrecommended production. At last, in November of the same year, it was forwarded by Mr. George Bloomfield to the late Mr. Capel Lofft, who then resided on his estate in the immediate neighbourhood of the poet's birth-place. The poem was accompanied by a letter containing the narrative of the author's life from which we have extracted the particulars given above. Induced probably, in part, to look into the manuscript by the circumstance of its being the production of a native of Suffolk, Mr. Lofft soon found the work to be well deserving of attention

on its own account. He forthwith entered into a correspondence with the author; and the result was the publication of the poem, after a few provincialisms and grammatical errors by which it was disfigured had been corrected, in the month of March, 1800. It immediately produced a considerable sensation; and, although a portion of the interest which was felt in regard to it is doubtless to be attributed to the extraordinary circumstances in which it was announced to have been written, it yet owed much of its popularity also to its intrinsic merits. Within three years after its appearance, seven editions, comprising in all twenty-six thousand copies, had been printed; and new impressions have since been repeatedly called for. It was early translated into French and Italian, and part of it even into Latin, which last circumstance drew from the poet a few verses printed among his minor productions.

The publication of the 'Farmer's Boy' at once called forth the author from obscurity to a fair prospect both of fame, and what to him must have been hitherto an unhoped-for degree of worldly prosperity. The change in his condition and expectations is well and graphically described in the simple language of his brother, whose exertions in his behalf had so large a share in bringing about what had now taken place. "I have him," he writes to Mr. Lofft, in reference to Robert's first appearance in London, "in my mind's eye, a little boy; not bigger than boys generally are at twelve years old. When I met him and his mother at the inn, he strutted before us, dressed just as he came from keeping sheep, hogs, &c.,—his shoes filled full of stumps in the heels. He, looking about him, slipped up: his nails were unused to a flat pavement. I remember viewing him as he scampered up: how small he was. I little thought that little fatherless boy would be one day known and esteemed by the most learned, the most respected, the wisest, and the best men of the kingdom." It is grati-

fying to know that those excellent and affectionate relations, his mother and brother, both lived to witness the prosperity of him who in other days had been to each the object of so much anxious care. It was the dearest of the poet's gratifications, when his book was printed, to present a copy of it to his mother, to whom upon that occasion he had it in his power, for the first time, to pay a visit, after twelve years' absence from his native village.

Bloomfield published several volumes of poetry after the 'Farmer's Boy'—among others a small volume entitled 'Rural Tales, Ballads, and Songs,' which were written, he tells us, during the interval between the completion of the composition of his first work and its appearance in a printed form. Soon after this, however, his health, which had never been very vigorous, began to give way; and he was obliged to resign an appointment in the Seal Office which had been given to him by the Duke of Grafton, and on receiving which he had relinquished his original trade. He now found his musical turn a resource—and realized a small income by manufacturing Æolian harps. But his health gradually grew so much worse, that he was at last obliged to leave London altogether, upon which he retired to Shefford in Bedfordshire. Here he remained till his death, on the 19th of August, 1823, in the fifty-eighth year of his age.

Although he was an extraordinary instance of what the force of native talent will sometimes accomplish where education has been nearly altogether withheld, Bloomfield gave plentiful evidence, especially in his first production, of the disadvantages under which he laboured from the want of early cultivation. Considering the circumstances under which it was written, and the intellectual training its author had had,—left to acquire his first notions of poetry from nothing better than the very indifferent magazine verses of that day,

and with no one of more judgment or experience in such matters than himself even to converse with,—the 'Farmer's Boy' is a surprising performance. Its descriptions of rural scenery and occupations are evidently taken, not from other books, but directly from nature; the tone of sentiment throughout is characterised by a manly and unaffected simplicity; the inspiration of true feeling reveals itself everywhere; and some passages,—for example, the sketch of the mad girl in the Autumn,—display pathos of a very high order. There is enough of faithfulness and vividness of delineation, and even of originality, to have furnished the soul and substance of a much better poem. But Bloomfield's skill in everything belonging to the department of execution, or workmanship, is of the very humblest order. Of the witchery of words he is nearly altogether destitute. He is remarkable for his deficiency in this respect even among uneducated or self-taught writers. Burns's felicities of expression play over his page like incessant outbreaks of sunshine; they are as frequent as in Horace, and not less brilliant; his style, wherever his genius is quite at its ease and working naturally, may be pronounced to be quite perfect; even Allan Ramsay often, when he has little other merit, pleases us by his mastery over the idioms and proprieties of his native Doric. But Bloomfield, in writing the English of books, was in truth struggling with the difficulties of a foreign language, and of one which he had never properly studied. His ordinary diction is fashioned after the very worst models. It is feeble and ineffective, not merely from being unpicturesque, but still more from being encumbered with a false and tawdry rhetoric, not more unlike the true language of poetry than that of common sense. It is not difficult to trace in this ambitious and unnatural style an imitation of the fashionable poetry of our magazines in the latter part of the last century. He has also, as was natural,

caught a good deal of what is worst in the style of his great predecessor, Thomson -- that empty swell of verbiage of which we have a good deal in the 'Seasons,' although it disappears so completely in the exquisite art of the 'Castle of Indolence.' A better education in his youth would have saved the homely genius of Bloomfield from being thus misled into affectations so uncongenial to its true spirit. He afterwards, indeed, learned to write with more correctness,—but rather with fewer faults than with more of real artistic life and power. Paradoxical as it may seem to say so, it is probable that he and some other self-taught writers, if they had been less self-taught, would have been more original. It is probably, indeed, a mistake to suppose that the circumstance of an individual having been what is called self-taught is generally favourable to the originality of his literary productions. There is more reason for suspecting, that even those self-taught writers who have displayed most of this highest element of power would have exhibited it in still greater abundance if they had enjoyed, in addition to their rare gifts of nature, the advantages of a regular education. It is certain, at any rate, that the literary performances of men who have been their own teachers have not, except in a few extraordinary cases, been in any degree peculiarly distinguished by this quality. Of the numerous tribe of self-taught verse-makers, especially, the great majority have been the merest imitators. A fair specimen of this race, the individuals of which, although they sometimes excite a temporary attention, generally drop very speedily into oblivion, we have in a writer named STEPHEN DUCK, who flourished in the early part of the last century. Duck was born about the year 1700, at the village of Charlton, in Wiltshire. He was at school for a short time in his boyhood, when he learned a little reading, writing, and arithmetic. When about fourteen, however, he was sent to work as an

agricultural labourer; and, being employed for several years in the lowest rural occupations, without ever opening a book, he soon forgot what little learning he had ever possessed. Still, as he used afterwards to tell, even at this time his thoughts were often engaged on subjects very foreign to his daily employments. At last he began to read a little, and this gradually inspired him with a desire to recover his lost knowledge, scanty as it had been. At this time he was about twenty-four years of age, with a wife and family to support; and, being engaged in hard work all day, he had but very little time for study. He was also without books, and had no money to buy any. Yet such was his ardour to obtain the means of instructing himself, that for some time, whenever he had an hour's release from his regular employment, he devoted it to extra work; and in this way he saved money enough to purchase, first, a treatise on vulgar fractions, then one on decimal fractions, and lastly, one on land-surveying. All these works he made himself master of, by studying them during the night, when everybody about him was asleep. Soon after this, he became intimately acquainted with a person in the same condition of life as himself, but who had passed some years in service in London, whence he had brought down a few dozens of books with him to the country. Of these some were treatises on arithmetic; among the others were the 'Bible,' 'Paradise Lost,' the 'Spectator,' Seneca's 'Morals,' 'Telemachus,' an English Dictionary and Grammar, Ovid, Josephus, seven plays by Shakespeare, and a few more by other writers; Dryden's 'Virgil,' 'Hudibras,' and the works of Waller and Prior. Duck had, it seems, been always fond of poetry and music; though hitherto the best specimens of either which he had had an opportunity of enjoying had been only a few rustic ballads. But his perusal of some of the above works inspired him with new enthusiasm, and in no long time he began to attempt writing verses

himself. The first poetical work by which he was greatly struck, was 'Paradise Lost.' Yet he read it through twice or thrice, with the aid of his dictionary, before he understood it. The new beauties he was continually discovering, however, made all this labour delightful. He studied the book, we are told, as a student of Greek or Latin would do one of the ancient classics, and making all the while almost as much use of his dictionary and grammar as if it had been written in a foreign language. These literary labours were still generally pursued during the night. Sometimes, however, he used to take a volume with him in his pocket when he went out to his daily work in the fields; and, if by working with more activity than usual he could get through what he had to do in less than the usual time, he would devote the few precious moments he had gained to the perusal of his book, to which he would sit down all perspiring as he was, thinking of nothing but how he might make the most of his short and hard-earned respite.

Even while at work he often employed himself in composing verses. It was some time before he thought of committing any of his compositions to paper; but at last he was induced to address a letter in verse to a gentleman, who, having heard of his acquirements, had sought him out, and made his acquaintance; and this effusion, having been shown to several other persons, was generally regarded as a very surprising performance for one in his circumstances. Some clergymen, in particular, to whom it was submitted, were so much pleased with it, that they rewarded the author with a small gratuity. From this time his talents began to be generally talked of, and, encouraged by the praise he received, he did not suffer his poetical faculty to lie dormant. The consequence was, that in a short time he had accumulated a respectable store of verse. It seems to have been not long before the year 1730, that Duck

attracted the notice of the Rev. Mr. Spence, already mentioned as the patron of Robert Hill, the learned tailor, and the blind poet Blacklock. Spence, who did himself great credit by the interest he took in these cases of indigent merit, immediately conceived the idea of bringing the claims of his *protégé* before the public in the most effective manner, through the press; and, accordingly, as many of his poems were collected as formed a quarto volume, which made its appearance in that year. Besides the general reputation which the author acquired by this publication, it procured for him the particular favour and patronage of Queen Caroline, who immediately settled upon him a pension of thirty pounds a-year. In 1733 he was made one of the Yeomen of the Guard. He now applied himself to the study of the Latin language—in which having made some progress, he was admitted into holy orders. On this the queen appointed him, in the first instance, keeper of her library at Richmond, and in a short time after he was preferred to the living of Byfleet, in Surrey. Meanwhile, a second edition of his poems had appeared in 1736, to which we find the names of the queen and other members of the royal family prefixed as subscribers. Duck became much beloved and respected by the people of Byfleet in his capacity of pastor, and lived there happily for many years. But the termination of his history is very melancholy. He at last fell into low spirits and drowned himself in the Thames, near Reading, in the year 1756. His poems have now long been forgotten. They had little merit, except considerable smoothness of versification, which even in those days the example of Pope had rendered a common quality.

CHAPTER XII.

H. K. WHITE; HAWKESWORTH; GOLDSMITH; MENDELSOHN.



ROBERT SOUTHEY.

In selecting our examples from the class at present under review of those who, in the midst of unfavourable circumstances, have distinguished themselves by their ardour in the pursuit of knowledge, there is one name not to be omitted, that of the gifted and amiable Henry Kirke White. As it is probable, however, that most of our readers are acquainted with the narrative of his life which has been so delightfully written by Southey, we shall confine ourselves to a short notice of its leading incidents. He was born in 1785, at Nottingham, where his father followed the business of a butcher. He was

sent to school at three years of age, and soon became so fond of reading, that, when he had got his book in his hand, it was difficult to get him to leave it even for a few minutes, that he might take his meals. When no more than seven, he began to attempt to express his ideas on paper; his first composition being a tale, which, ashamed to show to anyone else, he communicated to the servant, to whom he had for some time been secretly giving instructions in writing. His school acquisitions before the age of eleven, in addition to reading and writing, were arithmetic and French; in both of which studies he had already distinguished himself above all his schoolfellows. Soon after this he also began to write verse.

His father, however, who was anxious to bring him up to his own business, although very much against both the boy's own wish and that of his mother, now insisted that he should be employed one whole day in the week, and during his leisure hours on others, in carrying the butcher's basket. But he expressed so much dislike to this occupation, that it was at last arranged that he should be sent to learn the hosiery trade; and at the age of fourteen, accordingly, he began to work as a stocking-weaver. To a heart like his, full of the love of literature, and all whose young visions were already those of a student, this destination was a cheerless enough one. Yet he hardly dared to complain, for he knew that his family could scarcely afford to educate him to any higher employment. His mother, however, moved by his evident wretchedness, contrived, after he had been about a year at the loom, to prevail upon his father to allow him to be placed in the office of Messrs. Coldham and Enfield, attorneys in Nottingham, who agreed to take him without a premium, on condition of his serving two years before being articled.

He now felt himself in something like his proper sphere, and his whole mind assumed new alacrity. Al-

though nearly the whole day was necessarily given to the study of his profession, for he attended in the office, as he informs us himself in one of his letters, from eight in the morning till eight at night, he still found time to apply himself to the Greek and Latin languages; in the latter of which, with very little assistance, he enabled himself in ten months to read Horace with tolerable ease. This progress, however, was obtained at the cost of almost incessant application. He read during his walks, and at his meals; and not a moment, indeed, of his leisure was given to anything except the improvement of his mind. In this manner it is surprising how much he accomplished. The papers he left behind him showed, his biographer tells us, that he had applied himself to his legal studies with extraordinary industry. Beside the knowledge which he acquired of Greek and Latin, he also made considerable progress at this time in Italian, Spanish, and Portuguese. Chemistry, electricity, astronomy, all shared largely in his attention. While pursuing these severer studies, he contrived to accomplish himself to a considerable extent in drawing and music; and he found an occasional amusement in practical mechanics, in which he showed much ingenuity and neatness of hand. Another accomplishment which he wished to acquire was the art of extempore speaking; and with this view he got himself elected a member of a debating society, which then existed at Nottingham. Here he very soon distanced all his competitors.

But this was not the only mode in which he had already begun to seek distinction. So early as the first year after his emancipation from the stocking-loom, he had sent a translation from Horace to a periodical work then existing, called the 'Monthly Preceptor,' the proprietors of which were in the habit of offering prizes for the best compositions on subjects which they proposed; and a silver medal had been awarded to him for his performance. This honour seems to have kindled his lite-

rary ambition to greater fervour than ever. He began to sigh for the advantages of a University education. After having thus frequently tried his powers in the 'Preceptor,' he became a correspondent to another magazine called the 'Monthly Mirror.' Some of the essays which he sent to this publication were of distinguished merit, and attracted considerable notice. Among other persons whose attention they excited was Mr. Capel Lofft, whose patronage of Bloomfield we have recorded in the last chapter, and the encouragement of this gentleman, whose exertions had recently been so fortunate in the case of another poet, determined Henry to commit a volume of his verses to the press. This was about the close of the year 1802.

The volume made its appearance in the end of 1803, or beginning of 1804. It was published by subscription, and dedicated by permission to the Duchess of Devonshire. What pecuniary return it brought the author is not stated; but the sale probably did not do a great deal more than defray the expenses of the publication. Although favourably noticed in several of the periodical works of the day, it was made the subject of a very harsh article in the 'Monthly Review.' This so stung the sensibility of the young poet, that he sent a remonstrance to the editors, which produced from them, in their next number, an expression of their regret that Mr. White should have been so much hurt by the severity of their criticism, but no acknowledgement of the poetical merit of the publication they had condemned. This treatment distressed Henry exceedingly. In one of his letters he says, "This review goes before me wherever I turn my steps; it haunts me incessantly; and I am persuaded it is an instrument in the hand of Satan to drive me to distraction. I must leave Nottingham." Fortunately, however, the poems had fallen into the hands of Mr. Southey, who, bringing to their perusal both a better judgment and a kinder heart than the

writer in the 'Monthly Review,' considered them "to discover strong marks of genius." On afterwards seeing the review, this gentleman's indignation was so strongly excited by what he deemed its cruelty and injustice, that he immediately wrote to Henry a letter of encouragement and advice, with an offer to do anything in his power to forward his views. This generous and seasonable interference contributed greatly to heal the poet's wounded feelings, and enabled him in a short time to forget the sneers of his anonymous critic.

No prospect, however, had yet opened of his desire of going to the University being gratified; while the desire itself was every day growing stronger. The reading of some religious works about this time had made a great impression upon him; and his feelings had become ardently devotional. He determined to give up his life to the preaching of Christianity. His friends exerted themselves in vain to shake his resolution; he had made up his mind, if he could not obtain admission at Oxford or Cambridge, to join some dissenting communion, and to endeavour to find the means of pursuing his studies at an academy, or at one of the Scottish universities. But we must refer to Southey's interesting narrative for a detail of the alternating hopes and disappointments by which both his mind and frame were racked, before he at last secured the object of his fond ambition. At one time he had given up all hopes of ever being able to escape from his present profession; and the view which he took of the line of conduct which it became him to pursue in these circumstances is in the highest degree creditable to his sense of propriety and duty. "All my hopes," says he, in a letter to his mother, "of getting to the University are now blasted; in preparing myself for it I have lost time in my profession; I have much ground to get up, and, as I am determined not to be a *mediocre* attorney, I must endeavour to recover what I have lost." He immediately set

about a course of more severe application than ever, allowing himself rarely more than two or three hours of sleep during the night, and often never going to bed at all. This excessive application, after some time, brought on an alarming illness, from which his friends thought that he never entirely recovered.

But at last, through the influence of the Reverend Mr. Simeon, of King's College, Cambridge, to whom he had been recommended, a sizarship was procured for him at St. John's. His mother, who had for some years kept a boarding-school, and his elder brother, engaged each to allow him fifteen or twenty pounds yearly; and Mr. Simeon generously undertook to afford him thirty pounds more, with the aid of a friend, who is stated to have been Mr. Wilberforce,* a name made venerable by a life spent in doing good. Accordingly, in October, 1804, he quitted his employers at Nottingham, who had most kindly agreed to give him up the remainder of his time, although his services were every day becoming more valuable to them. He did not, however, immediately proceed to Cambridge, but, by Mr. Simeon's advice, placed himself for the first year in the house of the Rev. Mr. Grainger, of Winteringham, in Lincolnshire. While residing with this gentleman, he applied himself to classical learning with an ardour to which everything gave way, devoting often fourteen hours a-day to hard study; and, though his unremitting toils soon laid him once more on a sick-bed, convalescence came only to send him back to his books with as much zeal as ever. When he went to Cambridge, to use Southey's words, "the seeds of death were in him, and the place to which he had so long looked with hope served unhappily as a hothouse to ripen them."

The exertions of this extraordinary young man at the University were such as might have been expected from his previous career. A scholarship having become vacant

* Gorton's 'Biographical Dictionary,' vol. ii. p. 1181.

during his first term, he was advised to offer himself as a competitor for it; but, after having studied for this



W. WILBERFORCE.

purpose with his usual immoderate application till within a fortnight of the close of the term, he found himself so ill that he was obliged to decline coming forward. To add to his misfortune, he had now the general college examination before him; and, although far from well, he was urged, if it was at all possible, to persevere in preparing himself for this occasion. He followed this counsel, and, having by the aid of strong medicines been enabled to hold out during the six days of the examination, he was at its close declared the first man of his year. Immediately after this he went to London with

the view of benefiting his health by a temporary relaxation from study. But he did not make much progress in recovering his strength during this short excursion. Still, when he returned to Cambridge, his application continued unabated. It is mentioned as an instance of the manner in which he used to turn every moment to account—in his own phrase, to *coin* time—that he committed to memory a whole tragedy of Euripides, during his walks. At the end of this term he was again pronounced first man, and also one of the best theme-writers. By exhibitions, too, which were procured for him, he was now enabled to live without the assistance of his friends. At the end of the term a tutor in mathematics for the long vacation was provided for him by his college; but this unfortunately only induced him to continue his studies at a time when relaxation was become absolutely necessary to preserve his life. Finding himself very ill, he again proceeded to London; where however, as before, he got no better. He returned to the University worn out both in body and in mind, and, after a short attack of delirium, died on Sunday the 19th of October, 1806.

There has never, perhaps, been exhibited greater devotedness in the pursuit of knowledge than what we have here recorded; and the heart would be dead to all generous emotion that could follow without admiration the exertions of this enthusiastic and persevering spirit, as, in the face of all that would have quenched its hopes or driven it from its object, it still kept undismayed its onward path towards the far eminence it had so early resolved, if only life should not give way, to win. Never was there displayed by the most determined man a nobler steadiness than was evinced by this boy in the battle he fought for so many long years with fortune, for the good prize on which he had set his heart. The unsuitable and scorned occupation that darkened his entrance upon active life,—the incessant duties of his

next profession, by which his whole day was consumed, —the opposition of his friends when he proposed embracing his ultimate line of pursuit,—the difficulties by which he was at the same time impeded by his want of pecuniary resources,—and finally, the too manifest decay and sinking of his health under the labours which he deemed to be necessary to sustain the name he had acquired, and the expectations which had been formed of him, all, even when they pressed hardest upon him, had not the power to turn him from his purpose. Only death, striking him down as the soldier is struck down in battle, was able to subdue that aspiring heart.

A monument has been erected to the memory of Kirke White, in the Church of All Saints, Cambridge, at the expense of Mr. Boott, a native of the United States of America. Mr. Boott, on visiting Cambridge, was disappointed on finding no tablet recording the talents and virtues of the young poet: and he resolved to do what England had left undone. This circumstance deserves to be remembered as highly creditable to the American character, and as one amongst many evidences of the triumph of right feelings over those mutual jealousies which have too often separated nations sharing the same blood, and speaking the same language.

We shall conclude this chapter by the mention of one or two other individuals from the list of the cultivators of elegant literature, whose rise to eminence has been in like manner impeded for a time by untoward fortune. Dr. Hawkesworth, one of the most popular writers of the last century, and whose periodical work the 'Adventurer,' has given him a high place among the English essayists, was originally a watchmaker, and afterwards became clerk to a writing stationer, in which situation it was that he commenced his career as an author by some communications which he sent to the 'Gentleman's Magazine.' From this beginning he made his way, by the persevering exertion of his talents, both to distinction

and to considerable wealth. Hawkesworth must have been indebted for his literary acquirements almost entirely to himself. Together with his name may be quoted that of his much more distinguished contemporary, OLIVER GOLDSMITH, who was, however, more



OLIVER GOLDSMITH.

regularly educated. Goldsmith was one of nine children of a very poorly endowed clergyman of the Church of Ireland, in which country he was born in the year 1728. Of academical instruction he had his full share; for he attended successively the Universities of Dublin, Edinburgh, and Leyden. At the two last-mentioned places he studied medicine, which he had chosen as his pro-

fession, after having been originally intended for trade, and then successively for the church and the law. His eccentric and thoughtless habits, however, which had been constantly involving him in one difficulty or another from his boyhood, acquired strength with his years; and he had not been long at Leyden when he found himself reduced to a state of destitution as bad as that which a short time before had forced him to take flight from Edinburgh. On this he left the University, and set out to travel over the Continent, possessed of nothing in the world but the clothes he wore and his flute. It was on the latter he depended for his support, his practice being, when, after walking all day, he arrived at a village in the evening, to assemble the inhabitants around him to dance to his music, in return for which they generally gave him lodgings for the night, and wherewithal to procure him food for the next day. In this manner he walked over a great part of Flanders, the south of France, Germany, Switzerland, and Italy. At last he arrived in London, with, it is said, only a few pence in his pocket. In this emergency he was fortunate enough to meet with his countryman and college acquaintance, Dr. Sleigh, who had been one of Barry's first patrons when he came up to Dublin; and by the aid of this gentleman he obtained the situation of assistant teacher in a school at Peckham. Soon afterwards he offered his services to an apothecary in the metropolis, and with him he lived for some time. It was while in this situation that he first turned his thoughts to literary labour as a means of support. He began by writing for the 'Monthly Review' and the 'Public Ledger,' to which last he contributed the series of essays in the form of letters from a Chinese residing in England to his friends in China, which were afterwards collected and published under the title of 'The Citizen of the World.' He had been employed in this manner for several years, gaining only a scanty and precarious

livelihood, when, in 1764, he published his poem called 'The Traveller.' This immediately brought him into notice, and placed him among the first writers of the day. He had now better employment, and as much as he could undertake; but, his improvidence continuing as great as before, his difficulties were not much diminished. The very year following that in which 'The Traveller' appeared, Dr. Johnson found him unable to leave his lodgings in consequence of a debt he had contracted, and to pay which his kind friend disposed of the manuscript of his 'Vicar of Wakefield.' That exquisitely beautiful tale accordingly appeared in 1766; and soon after was published his 'History of England, in a series of Letters from a Nobleman to his son,' which immediately excited great attention and became extremely popular. From this time till his death, Goldsmith gave to the world a succession of works which prove that with all his faults a want of industry cannot be laid to his charge. His comedy of the 'Good-natured Man,' a 'History of Rome,' and another 'History of England' in four volumes, the poem of the 'Deserted Village,' the comedy of 'She Stoops to Conquer,' a 'History of Greece,' and his four volumes entitled a 'History of Animated Nature,' besides abridgements of his different historical works, and numerous minor pieces in prose and verse, all proceeded from his pen between the years 1768 and 1774, in the latter of which he died at the early age of forty-six. Nor are even those of the works we have enumerated which partake most of the character of mere compilations unmarked by many traces of the author's genius. Goldsmith, as Johnson has said of him on his monument in Westminster Abbey, touched no subject which he did not adorn—*nullum tetigit quod non ornavit*. The purity and elegance of his style, and the chastity, in all respects, of his manner as a writer, form a remarkable contrast to what we are told of his general conduct and demeanour, which is represented as exhibiting to the

last such a multitude of weaknesses and absurdities as made him, with all his powers, the object of ridicule to his acquaintances. And the dissimilarity is said to have been equally great between the wit, spirit, and good sense of his literary productions, and the folly or inanity of his conversation. All this is the more remarkable when we remember how comparatively late in life it was that he first appeared as a public writer. We might rather expect to find that he had brought to his new occupation the same wild heedlessness which he had displayed in everything else, and which had become so much a part of his character. But Goldsmith was an extraordinary instance how perfect the reflective or meditative powers of the mind will sometimes be, while those which fit a man for the business of active life are weak or wanting. A mere child as he seemed when called upon to exert the latter, in the ease with which he wielded the former he had few equals and no superior. As his friend Johnson used to say of him, with his pen in his hand he was a sage, without it a fool. Most of Goldsmith's follies, however, were the results of a simplicity and good nature, which did no dishonour to his heart, however they may have impeded his advancement in the world. From the time he rose into notice as a writer, till his death, he was the prey of his poorer brethren of the quill, who, when he had received any money for his works, borrowed or begged from him his last sixpence. Nay, he was often wont, it is said, to borrow money in order to satisfy these plunderers. The consequence was, that he was always in difficulties, which he certainly needed not to have been if he could have taken better care of his gains; for he was both one of the most successful and, as we have seen, one of the most industrious literary labourers of the day. Considering, indeed, the idle and wandering life he had so long led, Goldsmith's comparatively steady application in the latter years of his life, as testi-

fied by what he actually accomplished, deserves to be accounted not a little remarkable. It is probable, however, from the knowledge and general cultivation of mind which he displayed even in his first literary works, that he must long have been a more diligent student than might be supposed from the general sketch that has been handed down to us of his early history.

It would be very interesting to learn how he actually pursued his studies and acquired his literary taste and cultivation in circumstances so different from those amid which the generality of literary men have been reared. We should doubtless find his case to be another of those which demonstrate that, to the mind which is ardently ambitious of knowledge, all varieties of situation are much more nearly the same than they outwardly seem to be,—that of the art of acquiring the chief secret is the determination to acquire,—and that, this being possessed and steadily cherished, there are hardly any circumstances in which much may not be accomplished.*

At the same period with Goldsmith flourished the celebrated German Jew, MOSES MENDELSOHN. Mendelsohn was born at Dessau, the capital of the small principality of Anhalt, in 1729, the same year which gave birth to Heyne and Lessing. The copies of the Pentateuch which are used in the Jewish Synagogues are, as is well known, all in manuscript; and to transcribe these was the chief occupation of Mendelsohn's father. He also kept a day-school for the children of his Hebrew brethren. Nevertheless, with all his labours his gains were extremely scanty; and his son was accustomed from his earliest years to poverty and privation.

* Since this notice was first published, the biography of Goldsmith, after having had much new light thrown upon it by the late Mr. Prior, has been still further illustrated by the multifarious knowledge and research of Mr. Forster, and woven by his sympathizing eloquence into one of the most interesting and delightful narratives in the language.

After being taught the elements of Hebrew scholarship by his father, Moses was sent at an early age to a public seminary, where the other young Jews of the place who were intended for a learned profession were educated. The system pursued at this establishment, however, was little calculated to nurture or strengthen the more important mental faculties—the chief or rather almost the only exercise of the pupils being to get by heart portions of the Rabbinical commentaries, which they could not understand. It is said that when no more than seven years old Mendelsohn began to discern the absurdity of this method of study, and applied himself of his own accord to the obtaining of a correct acquaintance with the grammar of the sacred tongue as an indispensable preliminary to his further progress. So early as his tenth year he had begun to write verses in Hebrew. He was fortunate soon after this in obtaining the instructions of David Frankel, a man of profound learning, who was then chief Rabbi at Dessau, and whom the young student greatly attached to himself by his application and his thirst for knowledge. By Frankel's assistance and his own industry, the boy soon acquired a knowledge of the Scriptures and their principal commentaries, rare at that time even among the more learned classes of his nation.

The ardour with which he pursued his studies at this early age was too great for a frame which never had been very strong; and it brought on ere long a nervous disorder, the consequences of which remained with him during his life. It produced in particular a deformity of the spine, which was found to be incurable. The work which he had been most eagerly engaged in studying, when attacked with this illness, was the 'More Nevochim, or Guide for the Perplexed,' of the great Moses Maimonides, the learned Spanish Jew of the twelfth century; and in allusion to this circumstance Mendelsohn would long afterwards remark that it was

Maimonides who had spoilt his figure and ruined his constitution. "But still," he would add, "I doat on him for many hours of delight he has afforded me; and, if he has unwittingly weakened my body, has he not made me ample amends by invigorating my mind?"*

When Mendelsohn was about fourteen years of age, his friend and instructor Frankel left Dessau for Berlin, and he was now almost without an associate. It was time, besides, that he should think of doing something to gain his own subsistence. His father, accordingly, who was tenderly attached to him, and would willingly have kept him longer under his humble roof, was at last prevailed upon by his earnest entreaties to permit him to proceed to Berlin, in the hope that through Frankel's assistance he might procure some employment in that large city. The good Rabbi was scarcely able to do anything for him from his own resources: but he recommended him to a benevolent friend, who gave him an attic room in his house to sleep and study in, and allowed him two days' board every week. The only resource he possessed for a long time, in addition to this, was a little employment as a transcriber, which Frankel procured for him. With the proceeds of this he contrived to exist and to pursue his studies; but his privations were often very great. It was his custom at this time, as he used afterwards to relate, when he bought a loaf, to notch it into portions that might last him till he counted upon obtaining his next supply of money; and, however hungry, he would never eat more at a meal than he had thus allowed himself.

It was not at this period the practice among the Jews to study the classic languages; but Mendelsohn, inquisitive after all knowledge, and reading with avidity every accessible work which promised him any information, soon discovered that without an acquaintance with

* See 'Memoir of Mendelsohn,' by M. Samuels. Lond. 1825.

Greek and Latin his literary researches must remain extremely bounded. He therefore resolved to acquire these languages. But how he was to take the first step in this pursuit it was not very easy to understand. The Hebrew and the German were the only languages he knew, and there was no Greek or Latin grammar, as far as he was aware, written in either. In this difficulty a fortunate chance brought him acquainted with a brother Jew, a person of the name of Kish, from Prague, who was a medical practitioner, and knew something of Latin. Mendelsohn prevailed upon this man to give him gratuitously a quarter of an hour's instruction every day, till he had made himself master of the Latin nouns and verbs. When he had advanced thus far, he dispensed with his instructor. Having purchased for a trifle an old dictionary which had been very ill used, he considered himself to be in possession of all the necessary aid for commencing the work of translation; which accordingly he forthwith essayed on the first Latin book he could obtain. This, it is related, happened to be no other than a Latin translation of Locke on the Human Understanding—the whole of which he toiled through. After this achievement he applied himself to the Roman classics, and found that he could read them in general with ease and pleasure.

Mendelsohn's classical studies had probably already begun to subject him to unpleasant suspicions and imputations from the more bigoted among his Israelitish brethren. This may have been partly the reason that led him to attach himself about this time to a Polish Jew of the name of Israel Moses, who had come to reside in Berlin, having been obliged to leave his native country in consequence of being supposed to hold opinions too liberal for the taste of the great majority of his nation. This person, among his other acquirements, was a proficient in the mathematics—a branch of learning of which as yet Mendelsohn knew nothing. On the other hand,

Israel Moses was altogether ignorant of Latin. It was agreed therefore that the two friends should become each other's instructors. The Pole accordingly carried Mendelsohn through the elements of geometry by means of a Hebrew translation of Euclid; and in return received lessons from the latter in Latin and German. Such was the manner in which this ardent student availed himself of every chance opportunity of making a new acquisition in useful or liberal knowledge—rarely having it in his power to travel towards his object by the most direct and usual road, but not deterred on that account from seeking it by any by-path, however circuitous, that lay open to him.

During the time he remained at Berlin in obscurity and indigence, Mendelsohn's studies extended to many other subjects beside those we have mentioned. In particular he made himself familiar with both the French and English languages. But, after several years had passed away without improving his worldly circumstances, a rich Jew of the name of Bernard, who resided in the city, fortunately heard of his talents and his worth, and, being at the time in want of a tutor for his children, determined to employ him in that capacity. To poor Mendelsohn this was at that time an elevation that satisfied his highest ambition. He had now not only a comfortable home, but a salary which enabled him to buy books, and to take lessons in those branches of scholarship of which he was yet ignorant. It was after this that he began the study of the Greek language, to which he had not ventured to apply himself so long as he was unable to obtain the assistance of a master. The duties of his situation allowed him considerable leisure, which he devoted, with his wonted ardour, both to various new departments of science and literature, and to the further prosecution of those upon which he had already entered. He thus extended his mathematical acquirements to algebra and fluxions; while natural

philosophy, natural history, general history, and metaphysics, all came in for a share of his attention.

Among his other accomplishments were a remarkably beautiful hand-writing and great skill in accounts. Trivial as those acquirements may be deemed, it so turned out that to them, principally, Mendelsohn was indebted for the prosperity of his future life. His diligence in the performance of his regular duties, and his excellent general conduct, soon raised him high in the favour of his employer; but that gentleman was particularly struck with the talent he displayed in the arts we have just mentioned; and he at last resolved to remove him from the school-room to the counting-house, and to employ him as one of his clerks. From this situation he afterwards promoted him to a higher place in his establishment, which was a large silk-manufactory; and at last he appointed him manager of the whole concern.

Mendelsohn was now in the enjoyment of a handsome income; but neither this nor the laborious duties of his place relaxed his diligence as a student. His evenings, and a great portion of the night, were still regularly given to literature and philosophy. He had long looked with anxious and compassionate interest upon the general ignorance of his Hebrew brethren; and the desire of diffusing among them the light of modern literature and science had become, as it continued to be throughout his life, the first wish of his heart. With this view he projected, in conjunction with a friend, a Hebrew periodical work, to consist of short essays on such parts of science and morals as could most easily be made popular and interesting, to be entitled 'The Moral Preacher.' Of this work, however, the first in which Mendelsohn tried his powers as a public writer, only two numbers appeared; when he felt it prudent to discontinue it, in consequence of the outcry raised against it by his more bigoted brethren, to whom such an

attempt to displace their ancient rabbinical manuals of instruction seemed fraught both with presumption and profanity. But Mendelsohn, though turned from his course for the moment, was not thus to be driven to relinquish finally what he deemed to be as much the path of his duty as it was of his ambition.

About the year 1754, an event took place which greatly influenced Mendelsohn's future career; we mean his introduction to Gotthold Ephraim Lessing, afterwards so celebrated among the literary ornaments of his country, but who was then, like his new friend, a young man of five and twenty, and only beginning to be known as a writer. Mendelsohn is said to have been first made known to Lessing by a Jewish medical practitioner of the name of Gumpertz, by whom he had been assisted in learning some of the modern languages. They had also occasionally played at chess together; and it was as a proficient in this game that the young Jewish philosopher was first recommended to the acquaintance of the future author of 'Nathan the Wise.' But these two congenial minds soon turned their intercourse to higher ends. To Mendelsohn this connexion was especially important, inasmuch as it speedily introduced him to various other literary men then residing in Berlin, to whose society, from their difference of religious creed, he would not otherwise have had access. In this manner he became the intimate associate of Nicolai, Abbt, and others, who afterwards greatly distinguished themselves in the regeneration of the literature of their country. These young men were the principal supporters of various periodical works which were then carried on at Berlin; and Mendelsohn now joined his contributions to theirs. He had not yet, however, published any work in his own name; when one day his friend Lessing brought him a philosophical treatise which had just come out, and requested him to read it and give his opinion of it. On returning the

book some days afterwards, Mendelsohn observed that he thought he could without much difficulty refute the author's positions. Encouraged by his friend, he accordingly sat down to the composition of his reply. When he had finished it, he brought the manuscript to Lessing, and requested him to be kind enough to read it, which the latter promised to do as soon as he should be at leisure. At their next interview, however, somewhat to Mendelsohn's surprise, the matter was never mentioned by Lessing; and Mendelsohn was too modest to introduce it himself. This happened several times—till at last the anxious author ventured to ask his friend if he had found time to look at the manuscript. Lessing again complained of want of leisure: but promised him that he should certainly contrive to find time to read it immediately. "In the mean time," he added, "here is a small volume on the same subject, which has just appeared; take it home with you, and let me know what you think of it." Mendelsohn's surprise may be conceived when on opening this volume he found it to be his own work already in print—his 'Philosophical Dialogues,' as he had entitled it. "Put it into your pocket," said Lessing, enjoying his amazement, "and this Mammon along with it; it is what I got for the copyright."

From this time Mendelsohn took his place in the very front rank of the literary men of Germany. It does not, however, belong to so slight and rapid a sketch as the present even to enumerate the long succession of works by which, during almost every year of his remaining life, he sustained and added to his fame. For the classical elegance of his German style he was considered as ranking with the first of his contemporaries. His treatise, in particular, on the immortality of the soul, entitled 'Phaedon,' attracted, immediately on its appearance, universal attention, and, being translated into English, French, Dutch, Italian,

Danish, and Hebrew, spread the fame of the author over all Europe. But the great effort of his life still continued to be the moral and intellectual improvement of his brethren of the house of Israel. For this purpose he brought all the resources of his learning and genius to the illustration of the Hebrew Scriptures; and his translations of the books of Moses and the Psalms, the latter in verse, are reckoned among his ablest performances. The incessant literary labours of this remarkable man were often carried on under the pressure of ill-health, and always amidst the interruptions of business or of society. He eventually became the partner of Mr. Bernard in his silk-manufacturing establishment, and lived in the enjoyment of opulence. In his thirty-third year he married, and had the happiness before his death of seeing his family growing up around him. One of his publications, which he entitles 'Morning Hours,' consists of a series of lectures on natural philosophy, which he was for some years in the habit of delivering to his children every morning for two or three hours after sunrise. His habits of living were extremely simple and abstemious. "It was inconceivable," says Mr. Samuels,* to whose memoir we have been principally indebted for the above facts, "that the quantity of food to which he restricted himself could sustain a human being; and at the same time it was affecting to see him press his guests good-humouredly to partake of viands and liquors which himself, though ever so desirous, durst not venture to taste. * * * He was very fond of company, and never courted solitude, except from four or five o'clock in the morning till about eight or nine, when he adjourned to his counting-house, and remained there till noon. After dinner he generally attended to business again, till about four in the afternoon. About this hour his friends and

* 'Memoir,' pp. 139, 140.

pupils used to meet at his house: and, on his return, he usually found a numerous assembly in his room, who anxiously awaited his appearance. There were theologians, literati, philosophers, public functionaries, merchants, natives, foreigners, old and young, in promiscuous groups, with whom he conversed till eight o'clock, on various topics." Mendelsohn died, in consequence of a cold which he caught in returning one morning from the synagogue (in his attendance on which he was always extremely regular), on the 4th of January, 1786, in the fifty-eighth year of his age.

CHAPTER XIII.

JOHN OF SALISBURY; ROGER BACON.

The persons with whom we have been occupied in the chapters immediately preceding the present have all belonged to what may almost be called our own times; or, at least, their pursuits have been such as indicate an advanced state of literature, philosophy, and civilization generally. It is only within the last two or three centuries that anything like a spirit of independent speculation has formed a pervading characteristic of the literature of modern Europe. Up to that period the intellect of our forefathers may be said, in most of its efforts, to have walked in leading-strings. The peculiar circumstances in which literature sprung up a second time in western Europe, after the subversion of the Roman empire, sufficiently explain why it remained so long in a state of pupilage. But the extended period in modern history called the Dark Ages was only the night of the human mind, and by no means its sleep, as it has sometimes been described. The numbers of those who then applied themselves to literary pursuits were very great, and their zeal and industry in many cases such as has never been surpassed. As an evidence of the assiduity with which it was customary for men to devote themselves to the studies then in fashion, we may quote the account which our countryman John of Salisbury, who flourished in the twelfth century, gives us of the education he had received. "He says" (we quote the version of the original Latin which Mr. Turner has given in his 'History of England'*), "that, in the year after Henry I. died, he went to the Peripatetic

* Vol. i. p. 507.

School at Paris,* on the Mount of St. Géneviève, and there studied logic; he afterwards adhered to Master Alberic, as *opinatissimus dialecticus* (a dialectician in the highest repute), and an *acerrimus impugnator* (most keen impugner) of the Nominal sect. He was two years with him and Robert Metridensis, an Englishman, both men *acuti ingenii* and *studii pervicacis* (of acute genius and resolute studiousness). He then for three years transferred himself to William de Conches, to imbibe his grammatical knowledge. After this he followed Richard called the Bishop, retracing with him all he had learned from others, and the Quadrivium;† and also heard the German Harduin. He restudied rhetoric, which he had learned from Master Theodoric, and more completely from Father Helias. Being poor, he supported himself by teaching the children of the noble, and contracted an intimate acquaintance with Master Adam, an Englishman, and a stout Aristotelian. He prosecuted afterwards the study of logic with William of Soissons. Returning at the end of three years, he heard Master Gilbert on logic and on divine subjects; then Robert Pullen, and also Simon Periacensis, a faithful reader, but a heavy disputer. These two last were his only teachers in theology. Thus, he adds, I passed twelve years, occupied by these various studies."

One of the most extraordinary individuals that appeared during the dark ages was our countryman ROGER BACON; and his history affords us so admirable an example of the successful pursuit of knowledge in

* So translated by Mr. Turner; but the phrase in the original is *Ad Peripateticum Palatinum*, which means "*to the Peripatetic of Palais*," the common name by which the celebrated Abelard was known in that age, from his place of birth, Palais, in Bretagne.

† In the middle ages all the branches of elementary education were considered as comprehended in the two great divisions called the *Trivium* and the *Quadrivium:* the former of which embraced grammar, logic, and rhetoric; the latter, arithmetic, astronomy, geometry, and music.

the midst of all sorts of difficulties and discouragements, that we shall devote a few pages to present it with some fulness of detail. Bacon was born at Ilchester, in Somersetshire, in the year 1214. After remaining for some years at the University of Oxford, he went to finish his education at that of Paris, then the most distinguished seat of learning in Europe. Here he received his doctor's degree; after which he returned to his own country, and, entering himself a brother of the Franciscan order, again took up his residence at Oxford. At this time all the four orders of mendicant friars had establishments both at Oxford and Cambridge; and their members were, in truth, especially the Franciscans, the great support and ornaments of both Universities. At the period, however, when Bacon commenced his career, the Aristotelian metaphysics and logic, although they had begun to be studied, had scarcely acquired in this country that extraordinary ascendancy of which we find them only a few years after in possession. He, at all events, applied himself from the first chiefly to the mathematical and natural sciences, the principal of which, as cultivated at this time, may be distributed under the heads of chemistry or alchemy, astronomy or astrology, medicine, and mechanics. To these may be added, as having engaged a considerable share of Bacon's attention, the minor departments of geography, music, and optics; which last especially was one of his favourite studies, and that in which he displayed, more perhaps than in any other, his brilliant and inventive genius. Nearly all these sciences were as yet mixed up with the wildest errors and follies, which were, however, universally looked upon as their most fundamental and unquestionable principles, and were accordingly steadily kept in view by all who taught or studied either the theory or the practical applications of any of them. The grand object of chemistry, at the time to which we refer, was the discovery of the philosopher's stone, or

the secret of manufacturing gold; but the experiments which were constantly making with a view to this end had incidentally given birth to some real discoveries, especially in regard to the fusibility, malleability, and other properties of the different metals. Of these we may just state, that lead and copper were the two which the most persevering efforts were made to convert into gold, the former exciting the hope of a favourable result by its great weight, and the latter by its colour; no bad example of the purely imaginary grounds which formed the whole theory and foundation of this art. Medicine was in much the same condition with chemistry, being studied, also, chiefly in the writings of the Arabian doctors, who had taken a particular pleasure in mystifying this science with all manner of occult speculations, and bedizening it with their frivolous fancies and inventions. Its natural alliance with chemistry, in the first place, subjected it to be corrupted by all the absurdities of the Hermetic philosophy.* But, as these had originated chiefly in one of men's strongest passions, the love of wealth, so another passion still stronger, the fear of disease and death, operated in the case of medicine to give birth to a variety of other delusions, which retained their hold upon the public credulity with even yet more invincible obstinacy. In the unphilosophical times to which we now refer, the science of healing was little more than a heap of quackeries and superstitions; or at least the truths which it taught were so intermixed with the merest dreams and imaginations, and these latter were

* The science occupied with the pursuit of the philosopher's stone was so called in memory of the Egyptian philosopher Hermes, styled also Trismegistus, or the thrice-great (supposed by some to be the same personage with the heathen god Mercury), who, it was pretended, had first cultivated it about two thousand years before the birth of Christ, and to whom several existing works upon the subject were ascribed, although, it is needless to say, without any foundation.

held to be so much the more important and essential part of it, that, if not the very vainest and falsest of all the sciences of the period, there certainly was no other, even as then studied, which was disfigured upon the whole by more frivolity and nonsense. As the chemists thought of nothing but their elixir, or universal solvent, of the metals, so the physicians had their elixir vitæ, or universal medicine, which was to cure all diseases, and, if not altogether to put an end to the custom of dying, at least to protract life to more than antediluvian longevity. Then, the Arabian writers, in whose works the science was principally studied, had introduced into it a cloud of mystical and metaphysical notions from those other departments of inquiry to which they were almost all of them attached. One of the greatest of the Arabian physicians, Avicenna, was one of the most devoted admirers that ever lived of the metaphysical works of Aristotle; which, however, he ingenuously confesses he had perused no fewer than forty times before he understood them. Another of these doctors, Averroes, had written so many commentaries on the Greek philosopher, that he obtained the name of the most *Peripatetic** of the Arabians. Another of them, Alcendi (or Alchindus), had a strange theory with regard to the virtues of medicines, maintaining that they could only be properly mixed according to the principles of music —a notion which seems intended to defy all explanation or comprehension. But it was the intimate connexion it had formed with the philosophy of the stars, as then received, which gave to the medical science of the thirteenth and some succeeding centuries the greater part of its weakness and absurdity. Medicine, in truth, was for a long time considered as only one of the branches of astronomy or astrology, terms which in

* The philosophy of Aristotle was called the *Peripatetic*, from a Greek word signifying *to walk about*, because its founder was wont to walk about while he conversed with and instructed his disciples.

those days were synonymous. One of Roger Bacon's own expressions is, that the most important department of astronomy is the science of medicine. Operations, accordingly, used to be performed, and remedies administered, not so much in conformity to the appearance or nature of the disease, as according to the aspect of the constellations. For it was the study of the influence which the heavenly bodies were supposed to exert over human affairs and the fortunes of individuals that constituted the favourite astronomy of the times; or rather no part of astronomy was studied at all, except with a view principally to the observation and detection of this imaginary sympathy between the stars and men. In those days this was not the belief merely of a few of the most ignorant and credulous of the vulgar, but the nearly universal creed even of the learned. The science of judicial astrology, as it was called, from the judgments with respect to the future which its professors pretended by means of it to draw from the stars, was imported into Europe much about the same time with that of alchemy, and from the same Arabian school. The Arabian writers, however, had found it in the works of their predecessors, the disciples of the Greek school of Alexandria; and especially in their commentaries on a celebrated work by the geographer Ptolemy, now commonly known by the name of his 'Almagestum,' or 'Almagest,' although that is only an Arabic term, signifying The Great Work, which was bestowed upon the book as a complimentary title by those who translated it into that language. The 'Almagest' of Ptolemy may therefore be considered as the grand source of all the astrological superstitions both of the East and of modern Europe.

Bacon himself informs us in one of his works that, notwithstanding the state of unreclaimed barbarism in which all the more important departments of learning still remained, there never had been known such an

intellectual excitement as had arisen in his time. We have a gratifying proof of the zeal now felt in behalf of philosophy, and the honour in which it was held, in the reception Bacon is recorded to have met with on his return from France to his own country, to which he was welcomed as one of the glories of the age; while a sum of money was immediately collected and given to him to enable him to prosecute those scientific investigations by which he had already acquired so much celebrity. He tells us himself that in the course of twenty years he had been enabled by this liberality of his friends to expend, in collecting books, performing experiments, and constructing instruments, no less than two thousand pounds,—a much larger sum in those days than in our own. Thus encouraged and supported he pursued his researches in natural science for some time without interruption, and with a zeal and indefatigable application to which the works he has left us furnish abundant testimony. Unfortunately, however, for his peace, though nothing that is recorded of him is more honourable to the purity and intrepidity of his moral character, he could not remain a silent witness of the disgraceful ignorance and profligacy of the generality of his ecclesiastical brethren; and his denunciations upon this subject became at last so loud and unguarded that they reached the ears of those who were most certain both to feel their justice and never to forgive them. He immediately felt what it was to have provoked the hostility of so all-powerful a community as the church then was, and to stand as a mark for both the open fury and concealed rancour of a body of men, kept united and powerful by their common interests and common fears, and having in their hands, not only many of the terrors of civil authority, but the whole of that still more formidable power which belonged to an absolute supremacy over the creed, the consciences, and the passions of the people. The life of the philosopher becomes now, with

little intermission, only a tale of persecution and cruel suffering. The ignorance and stupid bigotry of the times made it unhappily too easy a matter for his enemies to find the means of amply avenging themselves. Two centuries before this the pope himself had experienced how perilous a task he attempted when he set about reforming the corruptions of the clergy. Gregory VII. had, about the time to which we refer, signalized his accession to the chair of St. Peter by some strenuous endeavours to repress the abounding irregularities which had long pervaded all ranks of the priesthood; when both the inferior clergy and many of the bishops themselves openly and indignantly repelled his interference, sarcastically replying to his exhortations and threatenings by asking him if he expected they were to live like angels. Nor was this all. The superior virtue and learning of the pontiff served only to expose him to the blackest imputations. The first was represented as a mere show of austerity, artfully kept up to cover a life of real dissoluteness. Of the other advantage was taken to point him out to popular horror as a magician or necromancer, a charge under which his memory long laboured, in common with that of some of the greatest men who were unfortunate enough to have lived in those dark times. This was the very calumny of which the enemies of Bacon availed themselves in order to destroy him. His great reputation as a master of the secrets of natural science, and the fame of his many ingenious experiments and contrivances, easily enabled them, in that ignorant age, to represent him both to the people and to the court of Rome as working his wonders by supernatural means, and as actually in league with the devil. Nothing more was necessary to effect his ruin. An order arrived from the pope, in the first instance, to restrain him from teaching, as he had been in the habit of doing, in the University; and, a short time after, he was put in confinement, secluded from all intercourse

with his friends, and, as we find him complaining himself, subjected to such cruel privations that he was often near perishing of hunger. In this state he remained probably for some years. Luckily, however, in the year 1264, the excellent and learned Cardinal Fulcodi, who had previously been Papal Legate in England, where he had known or heard of Bacon, became pope under the title of Clement IV.; and he, immediately on his accession, not only ordered the release of the philosopher, but took him under his especial protection. It was at the request of this pontiff that Bacon made that collection of his principal writings known by the title of his *Opus Majus*, or *Greater Work*, which, after remaining in manuscript for nearly five hundred years, was printed at London in the earlier part of last century. It consists, in fact, of a discourse on the various subjects to which the author's studies had been directed, written in the form of a letter to the pope; and, while it repeats, as was to be expected, many things to be found in his other works, may be considered as the most complete and connected account of his whole system of philosophy which has come down to us. But Clement reigned only about three years and a half; and with him expired Bacon's only security against the malevolence of his enemies. It does not appear that he was positively molested for some time; but, soon after the accession of Nicholas III., the general of his order, Jerome of Ascoli, ventured again to interdict the reading of his works, and to consign him to a prison, by a sentence which was confirmed by that pontiff. Bacon was at this time in the sixty-fourth year of his age, and he remained in confinement for ten years. At last Jerome of Ascoli became himself pope, under the title of Nicholas IV., and the persecuted old man, in the hope of being permitted to spend his few remaining days in freedom, stooped to appéal to the magnanimity of his former enemy, by addressing to him a treatise which he had composed in

his prison on the means of avoiding the infirmities of old age, as a sample of the speculations to which he was wont to devote himself, and an evidence of the innocence and usefulness of those studies which had been so much calumniated. Whether the vanity or better feelings of Nicholas were actually touched by this submission to his judgment and compassion does not very distinctly appear. It has been affirmed that the appeal was powerfully backed by the intercession of some of Bacon's most distinguished countrymen; but it is certain, at all events, that he soon after regained his liberty, and returned to his old residence at Oxford. Nor was he yet so completely worn out by age, hard study, and the cruelty of his oppressors, that he was ready only to lay himself down and die. On the contrary, he appears to have lived about six years after his deliverance, in the course of which he composed and published his work entitled 'A Compendium of Theology,' a manuscript of which is preserved in the King's Library, now forming part of that of the British Museum. He is commonly stated to have died in the year 1294, at the age of eighty.*

For the age in which he flourished Bacon was a miracle, and altogether deserving of the title by which his contemporaries distinguished him—the *Wonderful Doctor*. In his genius and intellectual character, indeed, he did not belong to his age. He scarcely participated in its prevailing tastes, or gave himself at all to its favourite studies. He complains, in one of his treatises, of the futile speculations which passed under the name of learning and philosophy in his time; when the Roman law was the sole object of attention among secular scholars, and those of his own order occupied themselves about nothing except the most perplexing subtleties of theology. Elegant literature and true science were alike

* Another account makes him to have survived only till the latter part of the year 1292.

neglected on all hands. Even those, he tells us, who professed the warmest admiration and most earnest study of the works of Aristotle had no acquaintance with that philosopher except through the medium of translations so wretched that they seldom conveyed the meaning of their originals nor any other meaning. He asserts, in another place, that there were not above four scholars in Christendom who knew even the rudiments of either Greek or Hebrew, much less of Arabic; while the Latin itself was so imperfectly understood that there was scarce one living writer who expressed himself in it with any degree of elegance or purity. Nor was the number of even tolerable mathematicians greater. Of those who applied themselves to that study, most stopped, he says, at the fifth proposition of Euclid. Hence this proposition used to be called the *Pons Asininus*, or *Asses' Bridge*, a name by which it is still known.

His own attainments, even as a scholar, to say nothing of his discoveries, were very extraordinary. He had travelled, indeed, the whole circle of literature and the sciences, in so far as it had been extended in those days, and surpassed his contemporaries as much in the depth and accuracy as in the universality of his knowledge. His Latin style, though by no means perfectly classical, is distinguished by an ease, neatness, and perspicuity, not to be found in any other writer of that dark era. He was distinguished besides for his knowledge of both the Greek and Hebrew languages, of the former of which he wrote a Grammar, which still exists in manuscript. It is remarkable for a curious passage it contains, in which it is gravely proposed, as a piece of ecclesiastical reform, that every bishop, in consecrating a church, should be obliged to write the characters of the Greek alphabet on the floor with the end of his pastoral staff, or, if that were too much for his scholarship, at least the three marks which were employed by the Greeks, in addition to their alphabetical characters, in

the notation of numbers. The study of languages was one, indeed, to which Bacon had given a great deal of attention. It forms the subject of the third book of his *Opus Majus*, and its importance is there vindicated by much ingenious and philosophical reasoning.

Ethics, theology, logic, and metaphysics enjoyed each of them its share of the attention of this universal genius, as we learn either from those of his works that still exist, or from others, now lost, that are recorded to have been written by him. But it is his scientific researches and discoveries that make the most brilliant part of his fame.

Some have gone so far as to consider Bacon the greatest mechanical genius that has appeared since the days of Archimedes. It is evident, from the testimony of his own writings, that he had at least speculated profoundly as to what might be done by mechanic power, and meditated many curious contrivances, some of which we can hardly doubt that he had actually executed, from the terms in which he speaks of them. In a little work, which he calls his 'Discovery of the Miracles of Art and Nature, and of the Nullity of Magic,' and which has been translated into English, he has a chapter on 'Admirable Artificial Instruments,' which, in reference to this point, is in the highest degree interesting. Among other machines which he speaks of here, although he does not describe their construction, are a ship which might be managed by one man as well as one of the common construction could by a whole crew; a chariot which ran with inconceivable swiftness entirely by machinery; an apparatus for flying; and an engine for depressing or elevating the greatest weights by the application of a very small force, which he describes as only three fingers high and four broad. Another instrument, he says, may be easily made whereby one man may, in despite of all opposition, draw a thousand men to himself, or any other thing that is tractable. A con-

trivance to serve the same purpose as the modern diving-bell is also mentioned. "Such engines as those," he remarks, "were of old, and are made even in our days." All of them, he tells us, he has himself seen, "excepting only," he adds, "that instrument of flying" (we use the words of the old English translation), "which I never saw, or know any who hath seen it, though I am exceedingly acquainted with a very prudent man who hath invented the whole artifice."

The errors into which this great man occasionally falls read us a valuable lesson in the right method of philosophizing. He was, to an extent very remarkable when we consider the age in which he lived, an experimental philosopher;* but still he had not learned by any means the whole importance of that diligent inquisition of nature which was, some centuries later, demonstrated by his illustrious namesake to be the one sure foundation of philosophy. There is one thing, accordingly, with which we cannot fail to be struck in following his speculations. His experiments are almost all directed, not to the *ascertainment* of principles, but only to their *exemplification*. It may sometimes have chanced that he did in this way discover, or rather obtain a hint of, a new truth in science, or a hitherto unsuspected property in the substances or instruments he was employing; but this was always merely an accidental result, and never the direct object of his examination of them. Hence, although he made some important additions to the truths of philosophy, he effected no diminution in the long list of errors and falsehoods by which it was in his time encumbered. With him, as with all his contemporaries, all was true that was generally believed, or that was to be found in any of those works which it was customary

* "Whoever," says Mr. Hallam, "reads the sixth part of the 'Opus Majus,' upon experimental science, must be struck by it as the prototype, in spirit, of the 'Novum Organon.'"—*History of the Middle Ages*, ii. § 81.

to regard as authorities. It is abundantly plain that he had no clear conception of the true grounds of belief in philosophy. With all the ingenious and original views, accordingly, in which his writings abound, they contain at the same time, it must be admitted, not a little of both hasty and extravagant inference. For not only does it never enter his imagination to doubt the correctness of anything that has been stated by his predecessors, or to examine nature with a view to ascertain the reality of those properties which they have imputed to her, but, with a corresponding ignorance or disregard of the true laws of evidence as to such matters, he continually advances to his general conclusions from much too limited an induction of particulars, and without anything like a sufficient consideration of the whole circumstances even of the cases to which his attention is directed. Thus, there can be little doubt that some even of the mechanical designs we have just mentioned were merely his imaginations of what might be accomplished by the most perfect combinations of certain natural powers, which, however, he had never actually applied so as to produce such effects, nor contemplated very attentively in any case with reference to all the conditions of his supposed invention. It is with the same looseness that we find him in another place asserting the possibility of making lamps that would burn for ever, and talking, on the authority of Pliny, of a certain stone which attracts gold, silver, and all other metals; "the consideration whereof," he remarks with some simplicity, "makes me think there is not anything, whether in divine or outward matters, too difficult for my faith." And, indeed, it appears to be so; for many of the stories which he quotes, especially those from Aristotle's 'Secretum Secretorum,'* which is one of his greatest authorities,

* Literally 'The Secret of Secrets,'—a spurious production, attributed to Aristotle, in high favour in the dark ages, and filled with the most ridiculous marvels and absurdities.

are such as one would think could hardly have failed to prove too monstrous for his belief, if it had not been of this infinite capacity.

The influence of this sanguine and over-credulous disposition is very discernible in his optical speculations. He was here blinded and misled in the most extraordinary manner by certain notions he had imbibed from the prevailing philosophy, upon the subject of what were called the *species* of objects, which were certain shadows, or images of themselves, which bodies of all kinds were imagined to be continually throwing off, and which, when received into the mind, constituted the *ideas* of the things from which they had come. In conformity with this singularly absurd theory (built up, however, by the schoolmen upon principles laid down or admitted both by Aristotle and Plato), Bacon contends, that any object may reflect upon another the *species* or image of whatever power or quality is inherent in itself; that a man, for example, may, by means of words spoken under strong emotion, transmit to another object, no matter whether sentient or not, such an emanation of the passion under which he labours, that a certain effect which he desires to operate on that object shall be thereby immediately produced. If such a phenomenon as this has never been actually exhibited, he conceives that it is owing solely to the emotion never having existed in sufficient intensity when the experiment was attempted. After this we need not wonder at what he says about the reflective powers of mirrors. Glasses, he assures us, "may be framed to send forth species, and poisonous infectious influences, whither a man pleaseth; and this invention Aristotle showed Alexander, by which he erected the poison of a basilisk upon the wall of a city," &c., &c. In another place we are informed, in a jargon which will scarcely bear trans lation, "that all things are to be known by the science of Perspective, since all the doings of nature take place

through the multiplication of species and virtues from the agents of this world into the patients." And many other passages might be quoted in the same style.

These were the prejudices of education, which even such a mind as that of Bacon was not powerful enough altogether to escape from. They were in part, too, the natural produce of that sanguine temperament which appertained to him as a man of inventive genius, and one given rather to look forward to the future than back upon the past. The minds that have enlarged the bounds of science by positive discoveries seem to be of a different order from those to which we are indebted for the demolition of ancient systems of imposture or delusion. Francis Bacon, who finally overthrew the despotism of Aristotle, and rid philosophy of the standard superstition by which it had so long been encumbered and overshadowed, achieved nothing beyond the old border-line of the territory which he had thus cleared. Newton, on the other hand, whose conquests were all on the outer side of this hitherto untraversed bourn, might, possibly, had he lived in another age, have failed to detect those consecrated errors in the method of philosophizing which were so happily exposed by Bacon.

Astronomy is another of the departments of mathematical physics in which Friar Bacon had made wonderful proficiency for his age. As a proof of this, we may mention, that he suggested, in a letter to his patron Clement IV., the same reformation of the Calendar which was introduced three hundred years afterwards by Pope Gregory XIII., and which has been long adopted by nearly all Christendom, our own government having formally recognised and enacted it in the year 1752; and Russia being now the only country in which the old reckoning prevails. Geography and chronology were also favourite studies of Bacon; and both are ably and learnedly treated of in sundry of those of his works which still exist.

We have already mentioned the extraordinary imaginations which in those days formed so important a part of physical science; and observed that, in regard to most of these, this great man had not risen above the universal faith of his age. He was a believer in all the wild pretensions both of astrology and alchemy. Of the latter art, indeed, he was one of the earliest disciples among the Latins, as the inhabitants of Western Christendom used then to be called, although it had been cultivated for several centuries before by the Jews and Saracens. But it is unnecessary to refer more particularly to any of his unintelligible disquisitions on these subjects, which, couched as they generally are in a most peculiar and mystical style, seem in truth hardly intended to convey any meaning even in the original, and certainly were never meant to be translated. It is sufficient to remark, that the influence of the stars upon human affairs is one of the fundamental laws of his astronomy; and that he has no doubt of the existence of a universal menstruum, or solvent, having the power both of converting all other metals into gold, and of purifying the human body from all its corruptions, and prolonging life through many ages. His knowledge in regard to the search of the *Elixir Vitæ*, gravely observes the author of a very elaborate life of him in the *Biographia Britannica*, "it is very probable he would have laid open more fully if his discourses upon these and other important subjects had been received with the candour they deserved. As it is, he has said enough to show that he was no pretender to this art, but understood as much of it (in this respect at least) as any who have lived since his time." The learned biographer, writing in the light of the eighteenth century, has not wholly escaped, we see, from the faith of the thirteenth.

In his pursuit of the philosopher's stone, however, Bacon had undoubtedly acquired a considerable knowledge of the properties of various natural substances,

and made several real discoveries in chemistry. Of these, the most remarkable of which his works give us any notice is his discovery of gunpowder. We have no account from himself of the manner in which he arrived at this discovery; but nothing can be more probable than the statement of another old writer, that he was indebted for it merely to the accident of a vessel, in which the different ingredients of the composition happened to be mixed, exploding on being heated. The way in which he himself mentions the matter is exceedingly curious, and very characteristic of the philosophy of the times. He describes the wonderful properties of his secret mixture in various parts of his works. For example, in his 'Treatise on the Miracles of Art and Nature,' he enumerates, among "his strange experiments," "the making of thunder and lightning in the air, yea, with a greater advantage of horror than those which are only produced by nature; for a very competent quantity of matter, rightly prepared (the bigness of one's thumb), will make a most hideous noise and coruscation." In another place he ventures so far as to intimate that the preparation in question is a compound of "nitre, or saltpetre, and *other ingredients*." In one passage only, however, and that in a chapter thrown in by way of appendix at the end of one of his works, does he actually record the names of these other ingredients. And even on this occasion, instead of declaring them plainly and at once, he wraps them up in a mysterious *anagram*, or series of syllables formed by an intricate transposition of the letters of which the words meant to be understood are composed. "The substance is prepared," says he, "from the *luru mope can ubre*, of saltpetre, and of sulphur." The sentence, of course, is in Latin; and the letters in italics, when restored to their proper order, make exactly the words *pulvere carbonum*, in English the *powder of charcoal*; so that the meaning of the whole is, that the composition

is formed by mixing together the powder of charcoal, of saltpetre, and of sulphur, the three ingredients, as is well known, from which gunpowder is generally made. This curious passage proves incontestably Bacon's possession of the secret; but it is not at all probable that it is to him or his writings that the world at large has been indebted for the knowledge of it: for it is singular enough, that the barbarous syllables to which he thus confided it retained their trust so faithfully, that they continued an unexplained riddle for nearly five hundred years, when their meaning was at last discovered by Dr. John Campbell, the ingenious author of the article on his life in the 'Biographia Britannica.'* It may be added, that this mode of recording scientific discoveries was common long after the time of Bacon, as might be proved by many examples which it would be easy to cite. Newton himself first announced an important portion of his doctrine of fluxions by an anagram.

Bacon's renown as a mighty magician, however, was the part of his fame that lived longest in the popular memory. It is entirely in this character that he figures in a very curious production which appears to have been a great favourite with our ancestors about the beginning of the seventeenth century, entitled 'The famous History of Friar Bacon, containing the wonderful things that he did in his life; with the lives and deaths of the two conjurors, Bungey and Vandermast: very pleasant and delightful to be read.'† In this veracious chronicle we are informed, that his father was a small farmer or peasant, who wished to bring up his son in his own

* Nor is it probable that Bacon was either the only or the first person even in the Western world who had hit upon the composition of gunpowder; and it had been known in the East from time immemorial.

† Not to be confounded with Robert Greene's blank verse play entitled 'The Honourable History of Friar Bacon and Friar Bungey,' some of the scenes in which, however, are evidently founded upon the prose tract.

condition of life, but that young Bacon, after a while, ran away to a cloister twenty miles off, where, under the tuition of the monks, he in a short time became the most wonderful scholar that was ever known. His reputation for necromantic skill, in particular, speedily waxed so great, that the king himself, being on a visit at the house of a gentleman in the neighbourhood, sent for Bacon from his monastery that he might see a sample of his enchantments. Instead, however, of quoting the account of his performances on this occasion, when he astonished and delighted all the five senses of the company in succession, we will pass on to the story of his fabrication of the marvellous brazen head, of which we read so much in all the old histories of the philosopher and his inventions. He took, as his coadjutor in this work, his friend Bungey (who is understood to have been Provincial of the order of St. Francis, in England), according to tradition an adept in the magical art, as well as himself; and the idea of the contrivance was suggested to them, we are told, by their anxiety to find out a mode of surrounding England with a wall of brass, to serve it for a perpetual protection against its enemies. After long deliberation about the way in which this was to be done, they resolved at last, the story proceeds, to construct a man's head of brass, in the hope that it would inform them. So to work they set, and some accounts affirm, we believe, that they were no less than seven years about their task before they finished it. But the most mortifying part of the business was, that, after the machine was completed, notwithstanding that (to use the words of the authority before us) "in the inward parts thereof there was all things like as in a natural man's head," not a syllable or a sound would it reply to all their questionings. In this extremity, they luckily bethought them of the simple expedient of raising a spirit to give them its advice in the matter; which they did accordingly; but the spirit threatened at first to

prove almost as obstinately dumb as the image, till, by dint of reasoning and menacing together, it was prevailed upon to remember its duty, when it "told them that with the continual fume of the six hottest simples it (the head) should have motion, and in one month space speak, the time of the month or day he knew not; also he told them, that, if they heard it not before it had done speaking, all their labour should be lost." Possessed of this information, the two friends took their places before the image, and sat watching it day and night for three weeks, when, feeling somewhat drowsy, they determined upon going to bed for a few hours, which they did not do, however, before they had placed Miles, Bacon's man, on guard in their stead, with strict injunctions to call them the first moment it should break silence. Miles, who acts a very conspicuous part throughout the whole history, had not watched long, when the head did, to be sure, open its lips, but only to utter the words *Time is*, which he in his wisdom thought greatly too commonplace a remark to warrant his interrupting his master's slumbers in order to notify it. Upon the same principle, when, half an hour later, it again found its tongue, and exclaimed *Time was*, he still remained at his post, not doubting that it would ere long commence something like a speech worth hearing, when it would be time enough to let the two philosophers know what was going on. Little did he dream of the catastrophe that was rapidly approaching. After the expiration of another half hour, the head for the last time lifted its voice, and, calling out *Time is past*, "therewith fell down, and presently followed a terrible noise, with strange flashes of fire, so that Miles was half dead with fear." His master, awakened by the turmoil, was at first, when he saw the ruin of all his hopes, in such a tremendous passion, that he had well-nigh killed him outright; but, on Bungey's entreaty, he was prevailed upon at last to content himself with striking him

dumb for a month, in order, we may suppose, to teach him for the future a higher and sounder appreciation of the gift of speech.

This fabrication of a brazen head, we may remark, is a feat which we find attributed to most of the few other individuals who were distinguished as cultivators of science in those times. William of Malmesbury, among the other wonders he relates of the famous Gerbert, who became pope in the year 999, under the title of Sylvester II., mentions such an image of his constructing, which was in the habit of answering many difficult questions. The same story is told of another very remarkable man, William of Paris, or of Auvergne, as he is sometimes called, who was born some years before Bacon, and has probably a better claim than the English philosopher to be accounted the father of alchemy among the Latins, while he is at the same time honourably known as a most profound and original thinker on moral and metaphysical subjects, in an age when these departments of philosophy were especially under the control of routine and authority. We read, too, of a brazen head made by one of Bacon's patrons and most intimate friends, the celebrated Robert Grostête, or Greathead, Bishop of Lincoln, a prelate of great talent and learning, but who had made himself obnoxious by his independent conduct, not only to the general body of the clergy, of whose corrupt manners he was a severe censor, but to the reigning pope Innocent IV. himself, some of whose impositions he had resisted with a boldness that might surprise those who have so read the history of the Roman Catholic Church as to have gathered no other notions with regard to it except that of the unlimited authority of its head, and the uniform and unquestioning obedience of its inferior members. Bishop Greathead, often called Robert of Lincoln, wrote several works, which still exist, both in theology and science; and was distinguished, like his friend

Bacon, for his philosophical as well as his mathematical knowledge. Lastly, we may mention the complete man of brass made by the famous Albertus Magnus, or Albert the Great, of which it is recorded that it was so fond of talking that Thomas Aquinas, while a pupil of Albert's, one day knocked it to pieces as a disturber of his studies. Albert was a contemporary of Friar Bacon, and like him long enjoyed the reputation of profound skill in the art of magic. He was undoubtedly a very extraordinary man. The extent and variety of his attainments seem to have been wonderful, for the age in which he flourished; and his industry and fertility as a writer must be regarded as almost unparalleled if he really composed the whole of that immense mass which was printed at Lyons in the middle of the seventeenth century, under the title of his Collected Works, in twenty-one volumes folio. A large portion of it consists of Commentaries on Aristotle, whose works, however, he knew only through the medium of the wretched Latin translations then existing.

Attached as Friar Bacon was to those vain speculations known under the names of the sciences of astrology and alchemy, he was so far from ever pretending to operate by supernatural means, that one of his works, his 'Treatise on the Miracles of Art and Nature,' to which we have already referred, is written principally for the purpose of proving the nullity or absurdity of what was called the Art of Magic, and exposing the tricks of its professors. In the beginning of this little work, after enumerating the various methods by which these impostors pretended to perform their wonders, he affirms that "no true philosopher did ever regard to work by any of these ways." And, immediately after, nothing can be more sensible than the manner in which he expresses himself on the subject of charms, spells, &c. "Without doubt," says he, "there is nothing in these days of this kind, but what is either deceitful,

dubious, or irrational, which philosophers formerly invented to hide their secret operations of nature and art from the eyes of an unworthy generation." The domination which he imagined the heavenly bodies to possess over human affairs was certainly an absurd dream; and so was his other favourite fancy about the tincture which possessed the power of curing all diseases, and turning everything into gold; but neither of them proceeded upon the idea of anything like supernatural or magical agency. The moral influence which he attributed to the stars, he conceived to be as truly a law of nature as that which directed their motions, or retained them in their orbits; and one, the operation and effects of which equally admitted of being made matter of calculation and science. In the same manner, his universal solvent was merely one of the yet undiscovered essences or compounds of natural chemistry, the expectation of ever finding which might be wild and unwarrantable enough, and the properties ascribed to it such, in fact, as nothing existing did actually possess; but still there was not necessarily anything magical, either about the supposed nature of the substance itself, or the manner in which it was to be applied, or even the processes and experiments by which it was sought to be discovered. It is quite true that some of the other cultivators of these visionary sciences professed to avail themselves of the aid of spells or spirits, or other supernatural means, in prosecuting their researches; but Bacon never did. The worst that can be said of him is, that his language, when he is speaking of the subject, is occasionally somewhat mystical—which arises, in a great part, it is but fair to observe, merely from his employment of the peculiar and technical phraseology of which the sciences in question, as well as all others, have their share. Nothing, therefore, could be more undeserved than the opprobrium to which he was exposed as a student of necromancy, or as one who ever even professed to work enchantments.

It has been said that this calumny only arose many years after his death, and that he himself never was annoyed by it; but both his history and his writings, we cannot help thinking, prove the contrary. In his treatise on Old Age, he distinctly complains of being hindered from making such experiments as he would have wished by "the rumours of the vulgar." And in various other passages we find him alluding to the difficulties and dangers which philosophy had to encounter from the same cause. It is gratifying, however, to observe, that in whatever spirit this accusation may have been originally brought against him, and with however much affected horror his name may have long been regarded by his brother-churchmen, who used to nail his books, we are told, to the shelves of their libraries, and to allow them to remain in that state covered with dust, and a prey to the moths and worms, he seems even, in his character of a magician, to have been a favourite with the people in general. In 'The Famous History of Friar Bacon,' instead of being represented as in league with the powers of evil, we find him on various occasions, opposing and foiling them in a style that would do honour to any legendary saint in the calendar; and when his fellow-conjurors, Bungey and Vandermast, are consigned, at the close of their career, to the usual fate of persons of their craft, he is, by an extraordinary piece of indulgence on the part of the chronicler, released from the dreadful penalty by being made, in a fit of repentance, to burn his books of magic, to turn anchorite, and to study divinity. Everything that is told of him, too, in this popular delineation, speaks in favour of the kind and generous manner in which he used to dispense his enchantments; and, upon the whole, he is represented to us, in point of moral character, very much in the same light in which his own writings, so evidently the produce of a simple, benevolent, and philosophic spirit, would lead us to

regard him. He was, indeed a genuine lover of knowledge and philosophy, for which he was ever ready to suffer all things,—preferring them infinitely to all things. He unfolds to us, in short, very clearly, what manner of man he must have been, by a single remark; when, speaking of one of his projects or contrivances, he calls it, with delightful enthusiasm, "an invention of more satisfaction, to a discreet head, than a king's crown."

CHAPTER XIV.

PROFESSORS OF OPTICAL DISCOVERY:—DOLLOND; RAMSDEN; HERSCHEL; THOMAS PHELPS AND JOHN BARTLETT; FRAUNHOFER; PALITZCH.

THE truth, as we have already remarked, with regard to many of the inventions mentioned by Friar Bacon, probably is, that he had rather deduced them as possibilities from the philosophical principles in which he believed, than actually realised them experimentally. Among others, certain optical instruments to which he attributes very wonderful powers existed merely, there can be little doubt, as conceptions of his mind, and had never been either fashioned or handled by him. His description of their properties is apparently nothing more than the sanguine prediction of an understanding enamoured of science, and confident in the truth of the views it has adopted, but which has not yet learned the difficult habit of scrupulously limiting its conclusions to the legitimate scope of its premises.

Bacon, however, certainly was acquainted with that important property of light termed its refrangibility, or that which makes it break from the straight line of its course, and turn into a new direction, on passing from one medium into another of different density. This property, indeed, had been long before noticed both by the Arabic writer Alhazen, whom Bacon repeatedly quotes under the name of Alharen; and also, there is reason to believe, by Ptolemy, who lived in the second century, in a work on Optics, likewise referred to by Bacon, but now lost. Nearly all that had been formerly known of

this branch of science, however, appears to have been forgotten in Western Europe when the fundamental fact of the refraction of light was again announced in the writings of our countryman, and proposed by him to be turned to account as affording the means of presenting objects to the eye in magnified dimensions. It is true that he uses extravagant language, and such as shows that he had never actually constructed the instrument of which he speaks, when he tells us that lenses may be so arranged as to enable a person, from an incredible distance, to count the grains in a plain of sand —to give to a man the appearance of a mountain—and to make the sun and moon seem to descend upon the earth. Nor does he even express himself very accurately, when, in another place, he notices the apparent enlargement of an object which may be produced by simply viewing it through a spherically-shaped piece of glass or crystal.* But all this only goes to show that he allowed his reasonings on the subject to be too much influenced by his imagination, and that he either did not conduct his experiments with much care, or at least did not always correctly note or record the circumstances. The partial errors that occur in his accounts ought not to deprive him of the honour he deserves as having been the first to reawaken the attention of men to inquiries so curious, and destined to conduct to such important results.

The invention of spectacles may be considered as having been traced, on evidence of unusual clearness in such matters, to about the time of the death of Bacon. By the testimony of more than one contemporary writer this useful contrivance is assigned to a Florentine named Salvini degl' Armati; although he, it is said, would have kept the secret to himself, had it not been for another subject of the same state, Father

* See the passages quoted in the original Latin in Montucla's *Histoire des Mathématiques*, i. 514—517.

Alexander de Spina, who, having found it out by the exertion of his own ingenuity and penetration, was too generous to withhold from the world so useful a discovery. This was about the close of the twelfth century. From this time magnifying or burning lenses continued to be made of various sizes. But nearly three hundred years more elapsed before any additional discovery of much importance was made in optical science; although in the early part of the sixteenth century Mamolicus of Messina, and soon after him Baptista Porta, began once more to direct attention to its principles by their writings and experiments. The latter is said to have first performed the experiment of producing a picture of external objects on the wall of a darkened chamber by the admission of the light through a lens fixed in a small circular aperture of the window-shutter, the origin of the modern Camera Obscura; and the former made an imperfect attempt to explain the phenomenon of the rainbow, as Roger Bacon had also done long before. The fortune of determining the true principles of this phenomenon, however, was reserved for Antonio de Dominis, Archbishop of Spalatro, who published his exposition of them in the year 1611.

It appears to have been about this time, also, or not long before, that the telescope was invented; although the accounts that have come down to us regarding this matter are extremely contradictory. As magnifying lenses had been long known, and were commonly in use, nothing is more probable than that, as has been suggested, more than one person may, ere this, have accidentally placed two lenses in such a position as to form a sort of rude telescope; and this may account for various evidences that have been adduced of something resembling this invention having been in use at an earlier period. But what is certain is, that the discovery of the telescope which made it generally known took place only about the close of the sixteenth century.

It seems also to be generally agreed, that it was in the town of Middleburg, in the Netherlands, that the discovery in question was made; and, moreover, that it was made by chance, although the accounts vary as to who was the fortunate author of it. The story commonly told is, that the children of a spectacle-maker, while playing in their father's shop, having got possession of two lenses, happened accidentally to hold them up at the proper distance from each other, and to look through them at the weathercock on the top of the steeple; when, surprised at seeing it apparently so much nearer and larger than usual, they called to their father to come and witness the phenomenon; after observing which he was not long in fabricating the first telescope. The wonderful powers of the new instrument were soon rumoured over Holland and other countries, and the account excited everywhere the greatest interest and curiosity. At last, as we have mentioned in a preceding chapter, it reached Galileo at Venice; and he re-invented the instrument by the application of his own sagacity and scientific skill.

The microscope was also discovered about the same time—but by whom is equally uncertain. These instruments, however, contributed greatly to revive a taste for optical investigations; and some of the greatest philosophers of the time, especially Kepler and Des Cartes, successively distinguished themselves in this branch of science, so that some of its most important principles were, ere long, much more accurately ascertained than they had hitherto been, and the phenomena depending upon them more correctly explained. The early part of the seventeenth century, indeed, exhibits one of the busiest periods in the whole history of optical discovery; nor did the almost constant advance of the science stop till the publication of the Dioptrics of Des Cartes in 1637.

Its next distinguished cultivator was James Gregory,

Professor of Mathematics, first at St. Andrews, and afterwards at Edinburgh, whose Latin treatise on Optics (entitled *Optica Promota*) appeared in 1663. It was he, as is well known, who, in this work, published when he was only four and twenty, first proposed the reflecting telescope—which, on that account, is often called by his name, although he did not actually construct such an instrument. This was first accomplished, a few years afterwards, by Sir Isaac Newton, whose investigations on the subject of light, in its whole extent, were destined to create, in regard to that department of physics, nearly as complete a change in the opinions of the age as that which he subsequently effected, by the publication of his 'Principia,' in regard to the mechanism of the heavens. By his celebrated experiment of interposing a prism, or triangular bar of glass, in the way of the solar beam, admitted through a small hole into an otherwise darkened chamber, he made it produce on the wall, not a white circle, as it would have done if allowed to pass on without interruption, but an elongated image, or spectrum, as he called it, displaying a series of seven different colours, namely, red, orange, yellow, green, blue, indigo, and violet,—hence often spoken of as the seven prismatic colours. This phenomenon proved the hitherto unsuspected facts,—first, that white or common light is, in reality, composed of seven different species of rays; and, secondly, that each of these several rays is refrangible in a different degree from the others, that is to say, that, on passing into a new medium, they do not proceed together in one direction, but each, starting from the common point of entrance, takes a separate course of its own, so that the beam spreads out into the resemblance of a fan. This is called the divergence, or *dispersion*, of the rays of light; and, from some other experiments which Newton made, he was induced to believe that whatever transparent substances or media *refracted* a beam of light in the same degree, or, in other

words, changed in the same degree its general direction, were also equal in their *dispersive* powers, or made the different rays separate from one another to the same extent. From this followed a very important consequence. The magnifying powers of the common telescope depended entirely upon the refraction of the light in its passage through the several lenses; but it could not undergo this operation without the rays being at the same time dispersed; and this necessarily threw a certain indistinctness over the image which such telescopes presented to the eye. Here, therefore, was, apparently, a defect in the refracting telescope which admitted of no cure; for, the dispersive bearing the same relation in all substances to the refractive power, you could not obtain the requisite refraction without its inseparable companion, the same amount of dispersion. It was this consideration which made Newton give up all thoughts of improving the refracting telescope, and apply himself, as Gregory had done, to the construction of one which should present its image, not by refracting, but by reflecting, the light from the object.

This rapid sketch of the progress made in the improvement of the telescope up to the beginning of the eighteenth century will be sufficient to enable the unscientific reader to understand the general nature and importance of a very happy discovery, which, since that time, has greatly improved that instrument, and of the author of which, one of the most remarkable examples of self-educated men, we are now about to give some account.

JOHN DOLLOND was born, in Spitalfields, on the 10th of June, 1706. His parents had come to this country from Normandy, on the revocation of the Edict of Nantes, in 1685; and, along with many thousands more of their countrymen, had established themselves in the above-named district of the English metropolis in their original business of silk-weavers. Dollond's

earliest years, also, were spent at the loom; and it had become the more necessary that he should apply himself to his trade with his utmost industry, in consequence of his father having died while he was yet an infant. Even during his boyhood, however, we are told, he began to show an inclination for the study of the mathematics; and before he was fifteen he used to amuse himself, during what little leisure he could command, in constructing sun-dials and solving geometrical problems, although at this time he had scarcely had an opportunity of looking into any book on these subjects. These early habits of study he continued as he grew up towards manhood; so that, notwithstanding the disadvantages under which he laboured, he had, ere long, accumulated a considerable store of learning on his favourite subjects of inquiry. He married early, and an increasing family forced him to make still more unremitting exertions for their support,—so that, although he seems now to have become a master manufacturer, he had still less time for private study than ever. But the leisure which business deprived him of during the day, he procured for himself, as many other ardent students have done, by stealing it from the hours usually allotted to sleep. In this manner he continued to improve himself in geometry and algebra: after which he applied himself to different branches of natural philosophy, and with especial ardour, it is recorded, to the kindred departments of astronomy and optics. But Dollond's studies at this time were not confined even to what is commonly called science. He found time to attain a competent knowledge of anatomy, to read a great deal of divinity, and even, without any instructor, to make himself so far master of the Greek and Latin languages as to enable himself to translate the New Testament from the one into the other. His studious reading, indeed, extended over many more subjects than we have here enumerated, and an excellent memory kept

its hold of an unusually large portion of whatever he read.

Such a man was destined for something above the handicraft to which he had been bred. Dollond, however, pursuing all the while his solitary studies, continued in his original business even for some years after his eldest son Peter was come to an age to join him in it. But Peter had also been his father's associate in his philosophical inquiries and experiments; and the tastes, as well as the knowledge, which he had thus acquired, naturally made him feel ambitious of entering upon some other line of exertion, in which his talents and attainments might find a more appropriate employment than his father's business afforded. So, after having been for some time in partnership with his father, he determined to set up on his own account as an optician. He was at this time only about twenty years of age, and does not appear to have received any other instructions in the art he had resolved to follow than those which his father had given him. But his ingenuity, skill, and diligence were speedily crowned with the success they deserved. So great was the encouragement he received, indeed, that after a short while it was arranged that his father should join him; and, accordingly, in the year 1752 John Dollond gave up his old business of a silk-manufacturer, and entered again into partnership with his son as an optician.

Being now free to devote his whole attention to the art, and the sciences connected with it, which had for so many years occupied his scanty leisure, he was not long in displaying the powers of his cultivated and inventive genius by various improvements on the instruments which he fabricated. Of these, however, we shall only notice the one from which his name derives its chief distinction.

We have stated above the conclusion to which Newton had arrived in regard to the dispersive power of dif-

ferent substances, namely, that it always bore a certain relation to the refractive power; and the inference which he thence drew as to the impossibility of improving the common or refracting telescope. In consequence of this decision of Newton, the attention of the students of optical science was, for a considerable time after, principally directed to the simplification of the reflecting telescope. But this instrument, especially when constructed of a large size, was attended with many inconveniences in the management, and, from the difficulty of keeping the mirrors clean, was extremely liable to get out of order. The reflected light, besides, was never so strong as that obtained by refraction. Notwithstanding, therefore, the coloured fringe in the image formed by the refracting telescope, that instrument still continued to be generally used for ordinary purposes. At length the distinguished mathematician, Euler, undiscouraged by the circumstance which had made Newton give up the same task in despair, resolved once more to make some attempt to correct the peculiar imperfection which had hitherto attached to it. He began his experiments about the year 1747; but, after continuing them for several years, he failed in obtaining any success. He published, however, several speculations upon the subject in the 'Berlin Memoirs,' which excited very general interest in the scientific world. In these papers he announced and proceeded upon a certain law with regard to the relation between the refractive and dispersive powers; and it was on the subject of this assumed principle of calculation that he was first opposed by Dollond. The ground which the English optician took was, that Euler's asserted law was irreconcilable with one of the experiments recorded by Newton—as in truth it was; but the experiment in question, and Dollond's inference from it, Euler attempted to show were alike inadmissible, on considerations which appeared to him to demonstrate the self-

contradiction to which they led. Dollond's paper, with Euler's reply, appeared in the 'Philosophical Transactions' for 1752; so that the controversy must have been commenced by Dollond some time before he set up as a regular optician.

It was some years after this that the Swedish mathematician, Klingenstierna, in a paper which he sent to the French Academy of Sciences, demonstrated on purely geometrical considerations the inadmissibility of the law which Dollond had deduced from the experiment made by Newton. Dollond, who had not been convinced by Euler's calculations, could not resist this new proof of the incorrectness of the principle which he had hitherto advocated; but, as it was a direct consequence, and acknowledged by all to be so, of what Newton had stated as the result of his experiment, it followed, of course, that this great observer had, for once, deceived himself; and that the only way to determine the point was to have recourse again to the fountain-head of all philosophy, the testimony of Nature. It is a striking evidence of the habitual reverence felt for Newton's accuracy, that, during all the time this dispute had been carried on, no one had till now adventured upon the task of following his footsteps over this intricate ground, and so tracing out where he had erred. This, however, Dollond at last determined to do; and, having begun his experiments in the year 1757, he prosecuted them in the spirit, as he says himself, of "a resolute perseverance;" till at length, after he had devoted nearly all his time to that one object for about a year and a half, in June, 1758, he found himself in a condition to lay before the Royal Society, as the result of his investigations, a new discovery of the most interesting nature. The experiments which he had made had refuted, not only the law which he had himself advanced with regard to the relation between the refractive and dispersive powers, but also, and as

completely, that which had been propounded by his opponent. Both these deductions had been equally founded on the assumption, sanctioned by the authority of Newton, that these two powers actually did always bear a certain relation to each other; but Dollond had now discovered that the amount of the one was, in fact, altogether independent of that of the other—that where two substances, in other words, had the same, or nearly the same, refracting power, their powers of dispersion might nevertheless be widely different; and conversely. Crown-glass and flint-glass, for instance, he found to differ very slightly in their power of refracting, or turning aside from its original course the entire beam of light which entered them from another medium; while, in dispersing the several rays of which it was composed, or, to repeat the figure we have already used, spreading them out into a fan, the former produced only two-thirds of the effect produced by the latter, so that when the rays were allowed to arrange themselves in a coloured spectrum, that image was in the one case a third longer than it was in the other.

The discovery of this hitherto unsuspected principle gave a new aspect to the whole subject of refraction, and at once pointed out the method to be adopted in order to remedy the great defect of the refracting telescope. To retain the requisite degree of refraction, and at the same time to get rid of the dispersion of the rays, it was necessary only to form the lens of two different glasses, or other transparent substances, so arranged that the dispersive powers of the one should counteract those of the other, while the refraction, or at least a sufficient amount of it, remain undestroyed. There were many experiments, it is true, to be made, before the idea thus suggested could be practically realized; but the perseverance and ingenuity of the same mind which had discovered the principle at length succeeded also in triumphing over the difficulties that lay in the way of

its application. Dollond was not long in producing refracting telescopes which presented images retaining scarcely a perceptible remnant of that coloured border always existing in the old instruments. When the successful result of his attempts was first reported abroad, many of the continental mathematicians refused for some time to give credit to his alleged discovery; and Euler, in particular, was still so prepossessed in favour of his own hypothesis, which the new doctrine overthrew, that he continued for several years to hold that the greater distinctness of the image in Dollond's telescopes arose from some other cause than the correction of the unequal refrangibility of the differently coloured rays. This illustrious philosopher, however, at last became convinced of his error, and frankly acknowledged it.

For this great discovery the Royal Society presented Dollond with the Copley Medal. The new telescope, to which the name of *Achromatic* (or Colourless) has been given, was afterwards considerably improved by its inventor; and has, since his time, been brought by others to still greater perfection. Meantime it spread the fame of the English optician over Europe, and gave him at once a high rank among the philosophers of his age. In 1761 he was elected a Fellow of the Royal Society, and appointed optician to his Majesty. But he did not live long to enjoy these honours. On the 30th of November, in the same year, while absorbed in the study of a newly published mathematical disquisition, he was suddenly struck with apoplexy, and died in a few hours. His son, who had been so long associated with him, carried on the business for many years, in such a manner as fully to sustain the reputation of the establishment, and it still subsists in his family.

The mention of Dollond naturally recalls the name of another of the most eminent of our English opticians,

the late Mr. JESSE RAMSDEN, who, in like manner, was not originally bred to the profession which he followed with such distinguished success. Ramsden was born in 1735, at Salterhebble, near Halifax, where his father kept an inn. The education he received in his boyhood embraced both a little Latin and the elements of geometry and algebra. But, when he was of the usual age for being put to a business, his father took him from school, and bound him apprentice to a clothier in Halifax; and in this line he continued till he reached his twentieth year, when he came up to London, and obtained employment as a clerk in a wholesale warehouse. He held this situation for about two years and a half; but in the meantime he had industriously availed himself of what leisure he could command to renew and extend his acquaintance with science; and so enamoured did he gradually become of these pursuits, that he at last resolved to make an effort to establish himself in some line more closely connected with his favourite studies than that which he had heretofore followed. With this view, notwithstanding that he was now so far beyond the age at which the learning of a business is usually begun, he bound himself apprentice for four years to Mr. Burton, of Denmark-court, a mathematical instrument-maker. On the expiration of this term, he and a fellow-workman of the name of Cole entered into business together, Ramsden serving the other as journeyman at a salary of twelve shillings per week. This connection, however, did not last long; and on its termination Ramsden opened a shop of his own. His chief employment for some time consisted in repairing optical and other mathematical instruments which had got out of order; and in this the industry and ability he displayed soon brought him into notice, and procured him a rapidly increasing business But he did not rest satisfied with merely performing in a superior manner such work as he

undertook of this description; the different instruments which passed through his hands forcibly attracted his attention to the imperfections by which they were severally characterised, and called his powers of contrivance into exercise in devising how they might be improved. In order to accomplish himself the more completely for this task, he laboured assiduously till he acquired, entirely by his own application, the art of grinding glass, and of handling the file, the lathe, and the other instruments used by opticians. Thus furnished with the practical skill and dexterity requisite to enable him to apply his ingenuity and mathematical knowledge, he proceeded to enter upon a regular and comprehensive examination of all the different optical instruments in use, with a view to the remedying of their several defects.

This resolution, and the perseverance with which it was followed up, eventually made Ramsden one of the greatest optical mechanicians that any country has produced. The list of the instruments which are indebted to him for the most ingenious and valuable improvements embraces nearly all those of greatest importance and most common use in astronomy and the connected sciences. Hadley's quadrant, the sextant, the theodolite, the barometer, the transit instrument, and many others too numerous to specify, all came out of his hands, it might almost be said, with new powers, and certainly, at all events, with much more in every case, than they before possessed, both of manageableness and of accuracy. In this last respect, especially, the instruments constructed by him far surpassed any that had before been known; and they were indebted for much of their superiority to a new dividing or graduating engine which he had contrived, the principle of which was extremely ingenious. It consisted essentially of a marker moved forward by the turning of a very fine-threaded screw. It is easy to make a screw with a

hundred turns of the thread in an inch; and by attaching to it a handle or index of sufficient length, so that the extremity may be over a properly divided circle of considerable magnitude, the movement of such a screw may be regulated with perfect precision to the thousandth part of one of its entire revolutions. Now, as by such a revolution it would only advance the marker the hundredth part of an inch, it is evident that, by being turned only the thousandth part of an entire revolution every time the marker is allowed to descend and make an impression upon the plate of metal or other surface to be divided, a hundred thousand equidistant lines may actually be drawn upon every inch of that surface. For this most useful contrivance the Board of Longitude awarded him a premium of 615*l.*, and in return he engaged to graduate whatever sextants were put into his hands for that purpose, at the rate of three shillings a-piece. His engine, indeed, enabled him to perform the operation in about twenty minutes, whereas it had been wont to occupy many hours.* But the additional accuracy which was given to the instrument to which it was applied by the new method was of still greater importance than its comparative expedition and cheapness. Hadley's quadrant, for instance, used to be so coarsely divided, and in other respects so defectively made, before it received Ramsden's improvements, that, in endeavouring to ascertain the longitude by it, the observation might in some cases lead to an error of fifty leagues; but Ramsden constructed it in so superior a manner, that even his commonest instruments did not admit of an error being fallen into of more than the tenth part of that amount, and with those of a more

* See a letter, dated London, 1st September, 1788, from Professor Piazzi of Palermo, to M. de Lalande, containing an account of Ramsden, in the *Journal des Savans* for November of that year. There is a translation of this letter, with a few notes, in vol. xvi. of Tilloch's *Philosophical Magazine*.

expensive description accuracy was insured in all cases to within a single league.

Soon after he commenced business, Ramsden married Miss Dollond, daughter of the inventor of the achromatic telescope, part of the patent for which came in this way into his possession. In 1786 he was elected a Fellow of the Royal Society, having been proposed by his friends without his knowledge, after his diffidence in his claims to such a distinction had made him long withhold his consent to their taking that step. In 1794 he was chosen a member of the Imperial Academy of Sciences at Petersburg; and in 1795 the Royal Society awarded him the gold medal annually bestowed by them for eminence in science.

The Reverend Lewis Dutens, the author of the 'Researches on the Origin of Discoveries,' who was intimately acquainted with Ramsden, has given us an account of his friend, which contains some interesting particulars of his character and habits. After noticing his great activity, the uncommon force of his reasoning powers, and the accurate and retentive memory with which he was endowed, the writer proceeds to remark, that perhaps, after all, the most distinguishing quality of his mind was a certain elegance. and taste for precision and high finish, which appeared not more in the instruments he manufactured than in everything he did. "This feeling for perfection," Mr. Dutens goes on to say, "led him, in the most minute and insignificant parts of his instruments, to a polish and grace, which sometimes tempted those to smile who did not perceive that the same principle which enabled him to carry the essential parts of his instruments to a degree of perfection unknown, and considered as impossible, before his time, induced him to be dissatisfied if a blemish of any sort, even the most trifling, appeared to his exquisite eye. To these uncommonly strong natural endowments he added all that the most constant and

intense study could bestow. Temperate to abstemiousness in his diet, satisfied with an extremely small portion of sleep, unacquainted with dissipation or amusement, and giving but very little time even to the society of his friends, the whole of those hours which he could spare from the duties of his profession were devoted either to meditation on further improvements of philosophical instruments, or to the perusal of books of science, particularly those mathematical works of the most sublime writers which had any connection with the subjects of his own pursuits. Mr. Ramsden's only relaxation from these constant and severe studies was the occasional perusal of the best authors both in prose and verse; and, when it is recollected that at an advanced age he made himself so completely master of the French language as to read with peculiar pleasure the works of Boileau and Molière, he will not be accused of trifling even in his lighter hours. Short and temperate as were his repasts, a book or a pen were the constant companions of his meals, and not seldom brought on a forgetfulness of hunger; and, when illness broke his sleep, a lamp and a book were ever in readiness to beguile the sense of pain, and make bodily sickness minister to the progress of his mind. Of the extent of his mathematical knowledge he was always from innate modesty averse to speak, although I have heard him say that he never was at a loss when his profession required the application of geometry. His knowledge in the science of optics is well known to have been perfect; and, when we add that the works of Bouguer and the great Leonard Euler were his favourite study, we shall not lightly rate his proficiency in mathematics. Of his skill in mechanics it is unnecessary to speak. Nor let it be supposed that his science in this profession was limited to the higher branch of invention and direction of the labours of others. It is a well-known fact, that such was his own manual dexterity,

that there was not any one tool, in any of the numerous branches of his profession, which he could not use with a degree of perfection at least equal to that of the very best workman in that particular branch; and it is no exaggeration to assert that he could with his own hands have begun and finished every single part of his most complicated instruments. It may not be foreign to this part of his character to observe, that his drawings were singularly neat and accurate, and his hand-writing so beautiful, that when he chose to exert his skill few writing-masters could equal it."

In order to insure that perfect accuracy which it was his object to give to every instrument he sold, Ramsden had all the parts of the work done under his own inspection; and for this purpose he kept men of every necessary branch of trade in his establishment. He availed himself also to the utmost of the advantages to be derived from the division of labour—allotting to every workman his particular department, from which he was never called away to another. He employed about sixty men in all; but such was his reputation over all Europe, and so numerous were the orders he received, that even with this large establishment he found it impossible to execute them with the requisite expedition. About this, indeed, he did not give himself much trouble; what alone he cared for was, that every instrument which bore his name should be worthy of his reputation, no matter what time or pains it should cost to make it so. No man was ever more nobly indifferent to the mere pecuniary gains of his art. If he had been anxious to enrich himself, he might have easily accumulated a large fortune; but for that object he would have had to enlarge his already extensive establishment so much further, that his personal superintendence of every part of it would have been impossible. So far was he from being influenced by any views of this kind, that it is asserted he never executed any one of the many great

works for which he received commissions from public bodies, both in his own and other countries, without being a loser by it as a tradesman. When an instrument did not answer his expectations, he never hesitated to take it to pieces, or to destroy it, whatever had been the cost bestowed upon its construction. Admirable as all his instruments were, too, for their accuracy, their high finish, their durability, and all the other qualities that make up the excellence of such productions, he generally put a less price upon them—in some cases a much less price—than was charged for inferior works of the same kind by other artists. The making of money was a very subordinate object with a mind so much elevated above the motives by which men are ordinarily governed, and sustained in a purer and freer atmosphere of its own by the love of science and philosophy.

Mr. Ramsden died on the 5th of November, 1800, at Brighton, to which place he had gone a short time before with the view of recovering his health, which, never vigorous, had latterly been greatly impaired by his unremitting exertions. He died possessed of only a small fortune; and, in the spirit in which he had lived, he left the greater part of it to be divided among his workmen, in proportion to their merits and their length of service.

One of the very greatest names in the modern history of astronomical discovery is that of the late illustrious SIR WILLIAM HERSCHEL; and he also was self-instructed in the science in which he earned his high reputation. Herschel was born, at Hanover, in 1738, and was the son of a musician in humble circumstances. Brought up, as well as his three brothers, to his father's profession, for which it has been said that he qualified himself without much teaching, he was placed, at the age of fourteen. in the band of the Hanoverian Guards. A detachment of this regiment having been ordered to England, in the year 1757 (or, according to another

account, in 1759), he and his father accompanied it; but the latter returned to Germany in the course of a few months, and left his son, in conformity with his own wish, to try his fortune in London. For a long time the young man had to struggle with many difficulties; and he passed several years principally in giving lessons in



SIR W. HERSCHEL.

music to private pupils in the different towns of the north of England. At last, in 1765, through the interest of a gentleman to whom his merits had become known, he obtained the situation of organist at Halifax; and next year, having gone to fulfil a short engagement at Bath, he gave so much satisfaction by his performances, that he was appointed to the same office in the Octagon Chapel of that city; upon which he went to reside there. The place which he now held was one of some value; and, from the opportunities which he enjoyed, besides, of adding to its emoluments by engagements at the rooms, the theatre, and private concerts, as well as by taking pupils, he had the certain prospect of deriving a

good income from his profession, if he had made that his only or his chief object.

But long before this his active and aspiring mind had begun to direct its attention to other pursuits offering a wider scope for the exercise of his talents. While yet only an itinerant teacher of his art in country towns, Herschel had assiduously devoted his leisure, not only to the making himself more completely master of the language of his adopted country, but also to the acquiring of a knowledge of the Italian, the Latin, and even the elements of the Greek. At this time, probably, he looked to these attainments principally with a view to the advantage he might derive from them in the prosecution of his professional studies; and it was no doubt with this view also that he afterwards applied himself to the perusal of Dr. Robert Smith's 'Treatise on Harmonics,' one of the most profound works on the science of music which then existed in the English language. But the acquaintance he formed with this work was destined ere long to change altogether the character of his pursuits. He soon found that it was necessary to make himself a mathematician, before he could make much progress in following Dr. Smith's demonstrations. He now, therefore, turned with his characteristic alacrity and resolution to the new study to which his attention was thus directed; and it was not long before he became so attached to it, that almost all the other pursuits of his leisure hours were laid aside for its sake.

During his residence at Bath, although greatly occupied with professional engagements, the time he devoted to his mathematical studies was rather increased than diminished. Often, we are told, after a fatiguing day's work of fourteen or sixteen hours among his pupils he would, on returning home at night, repair for relaxation to what many would deem these severer exercises. In this manner, in course of time, he attained a competent knowledge of geometry, and found himself in a condition

to proceed to the study of the different branches of physical science which depend upon the mathematics. Among the first of these latter that attracted his attention were the kindred departments of astronomy and optics. It has been stated* that Herschel's first attempts in the fabrication of magnifying-glasses were occasioned by his reading something upon that subject in a copy of Smith's 'Optics,' which accidentally fell in his way; but this story is perhaps nothing more than a version of the fact already mentioned, that his acquaintance with the mathematics began in his study of the 'Treatise on Harmonics,' by the writer in question. Another account of the matter, which has been given,† is, that, having in the course of his philosophical studies applied himself to the sciences of optics and astronomy, he became desirous of beholding with his own eyes those wonders of the heavens of which he read so much, and for that purpose borrowed from an acquaintance a two-feet Gregorian telescope. This instrument interested him so greatly, that he determined to procure one of his own, and commissioned a friend in London to purchase one for him, of a somewhat larger size. But he found the price was beyond what he could afford. To make up for this disappointment, he resolved to attempt to construct a telescope for himself; and, after encountering innumerable difficulties in the progress of his task, he at last succeeded, in the year 1774, in completing a five-feet Newtonian reflector. This was the beginning of a long and brilliant course of triumphs in the same walk of art, and also in that of astronomical discovery.

Herschel now became so much more ardently attached to his philosophical pursuits, that, regardless of the sacrifice of emolument he was making, he began gradually to limit his professional engagements and the number of

* By Lalande, in his continuation of Montucla's *Histoire des Mathématiques*, iii. 502.

† See 'Annual Biography,' vol. vii.

his pupils. Meanwhile he continued to employ his leisure in the fabrication of still more powerful instruments than the one he had first constructed; and in no long time he produced telescopes of seven, ten, and even twenty feet focal distance. In fashioning the mirrors for these instruments his perseverance was indefatigable. For his seven-feet reflector, it is asserted that he actually finished and made trial of no fewer than two hundred mirrors before he found one that satisfied him. When he sat down to prepare a mirror, his practice was to work at it for twelve or fourteen hours, without quitting his occupation for a moment. He would not even take his hand from what he was about to help himself to food; and the little that he ate on such occasions was put into his mouth by his sister. He gave the mirror its proper shape more by a certain natural tact than by rule; and when his hand was once in, as the phrase is, he was afraid the perfection of the finish might be impaired by the least intermission of his labours.

It was on the 13th of March, 1781, that Herschel made the discovery to which he owes, perhaps, most of his popular reputation. He had been engaged for nearly a year and a half in making a regular survey of the heavens, when, on the evening of the day that has been mentioned, having turned his telescope (an excellent seven-feet reflector, of his own constructing) to a particular part of the sky, he observed among the other stars one which seemed to shine with a more steady radiance than those around it; and, on account of that and some other peculiarities in its appearance, which excited his suspicions, he determined to observe it more narrowly. On reverting to it after some hours he was a good deal surprised to find that it had perceptibly changed its place—a fact which, the next day, became still more indisputable. At first he was somewhat in doubt whether or not it was the same star which he had seen on these different occasions; but, after continuing his observa-

tions for a few days longer, all uncertainty upon that head vanished. He now communicated what he had observed to the Astronomer Royal, Dr. Maskelyne, who concluded that the luminary could be nothing else than a new comet. Continued observation of it, however, for a few months, dissipated this error; and it became evident that it was, in reality, a hitherto undiscovered planet. This new world, so unexpectedly found to form a part of the system to which our own belongs, received from Herschel the name of the *Georgium Sidus*, or Georgian Star, in honour of the King of England; but by continental astronomers it has been more generally called either *Herschel*, after its discoverer, or *Uranus*. Subsequent observations, made chiefly by Herschel himself, have ascertained many particulars regarding it, some of which are well calculated to fill us with astonishment at the powers of the sublime science which can wing its way so far into the immensity of space, and bring us back information so precise and various. The diameter of this new globe has been found to be nearly four and a half times larger than that of our own. Its size altogether is about eighty times that of our earth. Its year is as long as eighty-three of ours. Its distance from the sun is nearly eighteen hundred millions of miles, or more than nineteen times that of the earth. Its density, as compared with that of the earth, is nearly as twenty-two to one hundred; so that its entire weight is not far from eighteen times that of our planet. Finally, the force of gravitation near its surface is such, that falling bodies descend only through fourteen feet during the first second, instead of thirty-two feet, as with us. Herschel afterwards discovered, successively, no fewer than six satellites, or moons, belonging to his new planet.

The announcement of the discovery of the *Georgium Sidus* at once made Herschel's name universally known. In the course of a few months the king bestowed upon him a pension of three hundred a year, that

he might be enabled entirely to relinquish his engagements at Bath; and upon this he came to reside at Slough, near Windsor. He now devoted himself entirely to science; and the constructing of telescopes, and the observation of the heavens, continued to form the occupations of the remainder of his life. Astronomy is indebted to him for many other most interesting discoveries beside the celebrated one which we have just noticed, as well as for a variety of speculations of the most ingenious, original, and profound character. But of these we cannot here attempt any detail. He also introduced some important improvements into the construction of the reflecting telescope—beside continuing to fabricate that instrument of dimensions greatly exceeding any that had been formerly attempted, and with powers surpassing, in nearly a corresponding degree, what had ever before been obtained. The largest telescope which he ever made was his famous one of forty feet long, which he erected at Slough, for the king. It was begun about the end of the year 1785, and on the 28th of August, 1789, the enormous tube was poised on the complicated but ingeniously contrived mechanism by which its movements were to be regulated, and ready for use. On the same day a new satellite of Saturn was detected by it, being the sixth which had been observed attendant upon that planet. A seventh was afterwards discovered by means of the same instrument. This telescope has since been taken down, and replaced by another of only half the length, constructed by Sir John Herschel, the distinguished son of the subject of our present sketch. Herschel himself eventually became convinced that no telescope could surpass in magnifying power one of from twenty to twenty-five feet in length. The French astronomer, Lalande, in his continuation of Montucla's 'History of the Mathematics,' states, that he was informed by George III. himself, that it was at his desire that Herschel was induced to make the telescope

at Slough of the extraordinary length he did, his own wish being that it should not be more than thirty feet long.

So extraordinary was the ardour of this great astronomer in the study of his favourite science, that for many years, it has been asserted, he never was in bed at any hour during which the stars were visible. And he made almost all his observations, whatever was the season of the year, not under cover, but in his garden, and in the open air—and generally without an attendant. There was much that was altogether peculiar to himself, not only in the process by which he fabricated his telescopes, but also in his manner of using them. One of the attendants in the king's observatory at Richmond, who had formerly been a workman in Ramsden's establishment, was forcibly reminded, on seeing Herschel take an observation, of a remark which his old master had made. Having just completed one of his best telescopes, Ramsden, addressing himself to his workmen, said, "This, I believe, is the highest degree of perfection that we opticians by profession will ever arrive at; if any improvement of importance shall ever after this be introduced in the making of telescopes, it will be by some one who has not been taught his art by us."

Some years before his death the degree of Doctor of Laws was conferred upon Herschel by the University of Oxford; and in 1816 George IV., then Prince Regent, bestowed upon him the Hanoverian and Guelphic Order of Knighthood. He died on the 23rd of August, 1822, when he was within a few months of having completed his eighty-fourth year.

To this distinguished name, and those of Dollond and Ramsden, it would be easy, if our space permitted, to add those of many other self-taught cultivators of the same departments of science. Among more recent opticians, no one has attained a higher eminence, either

as an artist, or as a scientific experimentalist and speculator, than FRAUNHOFER, late superintendent of the establishment for the manufacture of optical glasses at Munich, who rose from the condition of a common workman. Of astronomical observers, again, some might also be mentioned who have been of very humble station. There is a print—a copy of which may be seen in the rooms of the Astronomical Society—of two very remarkable individuals who were employed during a considerable part of the last century in the Earl of Macclesfield's observatory at Sherburn. The elder of these, as the inscription below the engraving informs us, was named THOMAS PHELPS, and he, it is stated, "from being a stable-boy, in the year 1718, to the then Lord Chief Justice Parker, afterwards Earl of Macclesfield, rose by his merit to the upper employments in the family, and at last, for his uncommon genius, was promoted to be Observer in the observatory at Sherburn Castle." Phelps, it is added, was born, at Chalgrove, in Oxfordshire, in January, 1694, and was in his eighty-second year when his portrait was taken. The other, JOHN BARTLETT, is described as having been "originally a shepherd, in which station he, by books and observation, acquired such a knowledge in computation, and of the heavenly bodies, as induced the late George, Earl of Macclesfield, to appoint him Assistant Observer in his observatory at Sherburn Castle." Bartlett was born, at Stoke Talmage, in Oxfordshire, August 22nd, 1721, Old Style, and was in his fifty-fourth year at the time his picture was taken. In the print Phelps is represented as standing looking through a telescope, while Bartlett is sitting by him with his tablets, or a sheet of paper, in the one hand, and a pen in the other, ready, seemingly, to note down what his associate may announce. There is a penetrating eagerness and sagacity in the eye and general aspect of the old man; and that of the other is also a striking head, with a less keen and vivacious

physiognomy than Phelps, but more massive, and indicating, perhaps, more of a meditative and calculating mind. In a manuscript note on the back of the copy of this print which belongs to the Astronomical Society, it is stated that "Phelps was the person who, on the 23rd of December, 1743, discovered the great comet, and made the first observation of it; an account of which is contained in the 'Philosophical Transactions,' but not the name of the observer." The comet of 1758, so famous in consequence of its return having been predicted more than half a century before by the great astronomer Halley, was also, it may be remarked, first perceived by an observer in a humble rank of life. It was on the 25th of December in that year that the luminary in question was detected with only the naked eye, at Prohlis, near Dresden, by a Saxon peasant of the name of PALITZCH, at a time when all the greatest astronomers in Europe were seeking for it in vain with their telescopes. Nor did Palitzch owe his discovery merely to his superior powers of vision. This Saxon peasant was really an astronomer. "George Palitzch," says Lalande, "born in the obscure condition of a common labourer, had succeeded both in finding happiness in his humble lot, and in acquiring various branches of knowledge which are rarely found possessed by men of higher stations who have had the advantage of a careful education. More in the way of being struck with the spectacle of the heavens than if he had lived in a town, he had, by his own efforts, studied and made himself master of astronomy, as well as those parts of geometry, such as plane and spherical trignometry, upon which it depends. By the exertion of a meritorious economy he had formed for himself an observatory, furnished with the instruments most important for the pursuit of his favourite study. Few opportunities of making interesting observations escaped him; and notwithstanding this his occupations as an agriculturist were duly

attended to. Natural History and Botany were also among the studies in which he took great delight; and he had a very well arranged cabinet of natural productions, as well as a garden full of rare plants, which he carefully cultivated. He was distinguished by such exceeding modesty, that he always refused even to give any details of his life, notwithstanding they must have been so full of interest. Such was the astronomer and philosopher Palitzch, to whom was reserved the honour of being the first of all the astronomers of Europe in the discovery of the return of this anxiously expected comet." Palitzch, we may add, who was born in 1723, continued to cultivate astronomy, as well as his garden and his fields, for many years after this event—and died at last in his native village in 1788. He had been for some time a corresponding member both of the Royal Society of London and of the Imperial Academy of St. Petersburgh.

CHAPTER XV.

DISCOVERY AND IMPROVEMENT OF THE STEAM-ENGINE:— JAMES WATT.

ALL the inventions and improvements of recent times, if measured by their effects upon the condition of society, sink into insignificance when compared with the extraordinary results which have followed the employment of steam as a mechanical agent; and the merit and honour of having first rendered it extensively available for that purpose are pre-eminently due to one individual, the illustrious JAMES WATT. The force of steam, now so important an agent in mechanics, was nearly altogether overlooked until within the two last centuries. The only application of it which appears to have been made by the ancients was in the construction of the instrument which they called the Æolipile, that is, the Ball of Æolus. The Æolipile consisted of a hollow globe of metal, with a long neck, terminating in a very small orifice, which, being filled with water and placed on a fire, exhibited the steam, as it was generated by the heat, rushing with apparently great force through the narrow opening. A common tea-kettle, in fact, is a sort of Æolipile. The only use which it was proposed to make of this contrivance was to apply the current of steam, as it issued from the spout, by way of a moving force—to propel, for instance, the vans of a mill, or, by acting immediately upon the air, to generate a movement opposite to its own direction. But it was impossible that any useful purpose should have been effected by such methods of employing steam. Steam depends so entirely for its existence in the state of vapour upon the presence

of a large quantity of heat, that it is reduced to a mist or a fluid almost immediately on coming into contact either with the atmosphere, or anything else which is colder than itself; and in this condition its expansive force is gone. The only way of employing steam with much effect, therefore, is to make it act in a close vessel. The first known writer who alludes to the prodigious energy which it exerts when thus confined is the French engineer Solomon de Caus, who flourished in the beginning of the seventeenth century. This ingenious person, who came to England in 1612 in the train of the Elector Palatine, afterwards the son-in-law of James I., and resided here for some years, published a folio volume at Paris in 1623 on moving forces; in which he states, that, if water be sufficiently heated in a close ball of copper, the air or steam arising from it will at last burst the ball, with a noise like the going off of a petard. In another place, he actually describes a method of raising water, as he expresses it, by the aid of fire, which consists in the insertion, in the containing vessel, of a perpendicular tube, reaching nearly to its bottom, through which, he says, all the water will rise when sufficiently heated. The agent here is the steam produced from part of the water by the heat, which acting by its expansive force upon the rest of the water, forces it to make its escape in a jet through the tube.* The supply of water is kept up through a cock in the side of the vessel. Forty years after the publication of the work of De Caus appeared the Marquess of Worcester's famous 'Century of Inventions.' Of the hundred new dis-

* In the same work De Caus proposes another apparatus for raising water simply by the pressure upon its surface in a close vessel of the air rarified by the heat of the sun. This process may be often observed taking place on a small scale in what is called the Fountain Inkglass, in which, in a warm day or a heated room, the liquid will be forced up sometimes to the very lip of the spout, by the expansion of the superjacent air within the vessel.

coveries here enumerated, the sixty-eighth is entitled 'An admirable and most forcible way to drive up water by fire.' As far as may be judged from the vague description which the marquess gives us of his apparatus, it appears to have been constructed upon the same principle with that formerly proposed by De Caus; but his account of the effect produced is considerably more precise than what we find in the work of his predecessor. "I have seen the water run," says he, "like a constant fountain-stream forty feet high; one vessel of water rarified by fire driveth up forty of cold water." This language would imply that the marquess had actually reduced his idea to practice; and if, as he seems to intimate, he made use of a cannon for his boiler, the experiment was probably upon a considerable scale. It is with some justice, therefore, that, notwithstanding the earlier announcements in the work of the French engineer, he is generally regarded as the first person who really constructed a steam-engine.

About twenty years after this, namely, in the year 1683, another of our countrymen, Sir Samuel Morland, appears to have presented a work to the French king, containing, among other projects, a method of employing steam as a mechanic power, which he expressly says he had himself invented the preceding year. The manuscript of this work is now in the British Museum; but it is remarkable, that when the work, which is in French, was afterwards published by its author at Paris, in 1685, the passage about the steam-engine was omitted. Sir Samuel Morland's invention, as we find it described in his manuscript treatise, appears to have been merely a repetition of those of his predecessors, De Caus and the Marquess of Worcester; but his statement is curious as being the first in which the immense difference between the space occupied by water in its natural state and that which it occupies in the state of steam is numerically designated. The latter, he says, is about

two thousand times as great as the former; which is not far from a correct account of the expansive force that steam exerts under the ordinary pressure of the atmosphere. One measure of water, it is found, in such circumstances, will produce above seventeen hundred measures of steam.

The next person whose name occurs in the history of the steam-engine, is Denis Papin, who was a native of France, but who, as his predecessor and fellow-countryman De Caus had probable also done, spent the part of his life during which he made his principal pneumatic experiments in England. Up to this time, the reader will observe, the steam had been applied directly to the surface of the water, to raise which, in the form of a jet, by such pressure appears to have been almost the only object contemplated by the employment of the newly discovered power. It was Papin who first introduced a piston into the tube or cylinder which rose from the boiler. This contrivance, which forms an essential part of the common sucking pump, is merely, as the reader probably knows, a block fitted to any tube or longitudinal cavity, so as to move freely up and down in it, yet without permitting the passage of any other substance between itself and the sides of the tube. To this block a rod is generally fixed; and it may also have a hole driven through it, to be guarded by a valve opening upwards or downwards, according to the object in view.* Long before the time of Papin it had been proposed to raise weights or heavy bodies of any kind by suspending them to one extremity of a handle or cross-beam attached at its other end to the rod of a piston moving in this manner in a hollow cylinder, and the descent of which, in order to produce the elevation of the weights, was to be effected by the pressure of the superincumbent atmosphere after the counterbalancing

* Vid. *supra*, p. 98.

air had been by some means or other withdrawn from below it. Otto Guericke used to exhaust the lower part of the cylinder, in such an apparatus, by means of an air-pump. It appeared to Papin that some other method might be found of effecting this end more expeditiously and with less labour. First he tried to produce the requisite vacuum by the explosion of a small quantity of gunpowder in the bottom of the cylinder, the momentary flame occasioned by which he thought would expel the air through a valve opening upwards in the piston, while the immediate fall of the valve, on the action of the flame being spent, would prevent its re-intrusion. But he never was able to effect a very complete vacuum by this method. He then, about the year 1690, bethought him of making use of steam for that purpose. This vapour, De Caus had long ago remarked, was recondensed and restored to the state of water by cold; but up to this time the attention of no person seems to have been awakened to the important advantage that might be taken of this one of its properties. Papin for the first time availed himself of it in his lifting machine, to produce the vacuum he wanted. Introducing a small quantity of water into the bottom of his cylinder, he heated it by a fire underneath, till it boiled and gave forth steam, which, by its powerful expansion, raised the piston from its original position in contact with the water, to a considerable height above it, even in opposition to the pressure of the atmosphere on its other side. This done, he then removed the fire, on which the steam again became condensed into water, and, occupying now about the seventeen-hundredth part of its former dimensions, left a vacant space through which the piston was carried down by its own gravitation and the pressure of the atmosphere.

The machine thus proposed by Papin was abundantly defective in the subordinate parts of its mechanism, and, unimproved, could not have operated with much effect.

But, imperfect as it was, it exemplified two new principles of the highest importance, neither of which appears to have been thought of, in the application of the power of steam, before his time. The first is the communication of the moving force of that agent to bodies upon which it cannot conveniently act directly, by means of the piston and its rod. The second is the deriving of the moving force desired, not from the expansion of steam, but from its other equally valuable property of condensibility by mere exposure to cold. Papin, however, it is curious enough, afterwards abandoned his piston and method of condensation, and reverted to the old plan of making the steam act directly by its expansive force upon the water to be raised. It is doubtful, however, whether he ever actually erected any working-engine upon either of these constructions. Indeed, the improvement of the steam-engine could scarcely be said to have been the principal object of those experiments of his which, nevertheless, contributed so greatly to that result. It was, in fact, as we have seen, with the view of perfecting a machine contrived originally without any reference to the application of steam, that he was first induced to have recourse to the powers of that agent. The moving force with which he set out was the pressure of the atmosphere; and he employed steam merely as a means of enabling that other power to act. Even by such a seemingly subordinate application, however, of the new element, he happily discovered and bequeathed to his successors the secret of some of its most valuable capabilities.

We may here conveniently notice another ingenious contrivance, of essential service in the steam-engine, for which we are also indebted to Papin—we mean the safety-valve. This is merely a lid or stopper, closing an aperture in the boiler, and so loaded as to resist the expansive force of the steam up to a certain point, while, at the same time, it must give way and allow

free vent to the pent-up element, long before it can have acquired sufficient strength to burst the boiler. The safety-valve, however, was not introduced into the steam-engine either by Papin, or for some years after his time. It was employed by him only in the apparatus still known by the name of his *digester*, a contrivance for producing a very powerful heat in cookery and chemical preparations by means of highly concentrated steam.

We now come to the engine invented by Captain Savery in 1698. This gentleman, we are told, having one day drunk a flask of Florence wine at a tavern, afterwards threw the empty flask upon the fire, when he was struck by perceiving that the small quantity of liquid still left in it very soon filled it with steam, under the influence of the heat. Taking it up again while thus full of vapour, he now plunged it, with the mouth downwards, into a basin of cold water, which happened to be on the table, by which means, the steam being instantly concentrated, a vacuum was produced within the flask, into which the water immediately rushed up from the basin. According to another version of the story, it was the accidental circumstance of his immersing a heated tobacco-pipe into water, and perceiving the water immediately rush up through the tube, on the concentration by the cold of the warm and thin air, that first suggested to Savery the important use that might be made of steam, or any other gas expanded by heat, as a means of creating a vacuum. He did not, however, employ steam for this purpose in the same manner that Papin had done. Instead of a piston moving under the pressure of the atmosphere through the vacuum produced by the concentration of the steam, he availed himself of such a vacuum merely to permit the rise of the water into it from the well or mine below, exactly as in the common sucking-pump. Having thus raised the water to the level of the boiler,

he afterwards allowed it to flow into another vessel, from whence he sent it to a greater height by the same method which had been many years before employed by the Marquess of Worcester,—namely, by making the expansive force of the steam act upon it directly, and so force it up in opposition to its own gravity and the resistance of the atmosphere.

Savery showed much ingenuity and practical skill in contriving means of facilitating and improving the working of the apparatus which he had devised upon these principles; and many of his engines were erected, for supplying gentlemen's houses with water and other purposes, in different parts of the country. The machine also received many improvements after the death of the original inventor. It was considerably simplified, in particular, by Dr. Desaguliers, about the year 1718; and this gentleman also contrived a method of concentrating the steam by the injection of a small current of cold water into the receiver, instead of the old method employed by Savery, of dashing the water over the outside of the vessel, which cooled it to an unnecessary degree, and occasioned, therefore, a wasteful expenditure of fuel. It was Desaguliers who first introduced the safety-valve into the steam-engine, although Papin had previously suggested such an application of the contrivance. Engines upon Savery's principle have continued to be constructed down to our own times; and, as they can be made at a comparatively small expense, they are found to answer very well in situations where water has to be raised only a short way. This engine is, in fact, merely a combination of the common sucking-pump (except that the requisite vacuum is produced by the condensation of steam, and without the aid of a piston) with the contrivance proposed by De Caus and the Marquess of Worcester for the application of the expansive force of steam; and, wherever the machine can be economically employed, the former

part of it is that which operates with by far the most effect.

Not long after Savery had invented his engine, Thomas Newcomen, an ironmonger, and John Calley, a glazier, both of Dartmouth, in Devonshire, began also to direct their attention to the employment of steam as a mechanic power. Their first engine was constructed about the year 1711. This contrivance, which is commonly known by the name of Newcomen's engine, proceeded mainly upon the principle formerly adopted by Papin, but subsequently abandoned both by him and those who immediately followed him in the cultivation of this department of mechanics, of making the moving power of the machinery the weight of the atmosphere acting upon a piston, so as to carry it down through a vacuum created by the condensation of the steam. Newcomen's apparatus is, on this account, often distinguished by the name of the atmospheric engine. Its inventors, however, instead of adopting Papin's clumsy method of cooling his steam by the removal of the fire, employed, in the first instance, the expedient of pouring cold water on the containing vessel, as Savery had done before them, though without being aware, it is said, of his prior claim to the improvement. They afterwards exchanged this for the still better method, already described as introduced by Desaguliers into Savery's engine, of injecting a stream of water into the cylinder, which is said to have been suggested to them by the accident of some water having found admission to the steam through a hole which happened to have worn itself in the piston. This engine of Newcomen, which in the course of a very few years after its invention was brought to as high a state of perfection as the principle seems to admit of, afforded the first important exemplification of the value of steam in mechanics. Savery's, the only other practical contrivance which had been proposed, had been found quite inadequate to the

raising of water from any considerable depth; its principal power, as we have already remarked, lying, in fact, in the part of it which acted as a sucking-pump, and by which, as such, water could only be raised till its column was of equal weight with a column of the atmosphere of the same base.* It was nearly useless, therefore, as an apparatus for pumping up water from mines, the grand object for which a moving force of extraordinary power was at this time in demand. But here Newcomen's engine proved of essential service. Many mines that had long remained unwrought were, immediately after its invention, again rendered accessible, and gradually excavated to great depths; while others were opened, and their treasures sought after with equal success, which but for its assistance could never have been attempted. It was applied also to various other important purposes.

Newcomen's engine, however, notwithstanding its usefulness, especially in cases where no other known power could be applied, was still in some respects a very defective contrivance, and by no means adapted to secure the complete command of the energies of steam. The great waste of fuel, in particular, which was still occasioned by the degree to which the cylinder was cooled after every stroke of the piston, from the cold water injected into it, rendered it scarcely any saving of expense to employ this engine in circumstances where animal power was available. Its whole force too, the reader will observe, as a moving power, was limited to what could be obtained by atmospheric pressure alone; which, even could the vacuum under the piston have been rendered quite perfect, and all obstructions from friction annihilated, could only have amounted to about fifteen pounds for every square inch of the surface of the piston. The expansive force of

* See vol. i. p. 16.

steam was not, in fact, at all employed in this contrivance as a moving power: could the vacuum necessary to permit the descent of the piston have been as expeditiously and conveniently produced by any other agency, that of steam might have been dispensed with altogether. An air-pump, for instance, attached to the lower part of the cylinder, as originally proposed by Otto Guericke, might have rendered all the service which steam was here called upon to perform; and in that case, this element, with the fuel by which it was generated, might have been dispensed with, and the machine would not have been a steam-engine at all. This view of the matter may in some degree account for the complete neglect of steam as a moving power which so long prevailed after Newcomen's engine was brought into use, notwithstanding the proofs of its capabilities in that character which had been afforded by the attempts of the earlier speculators. It was now regarded simply as supplying the easiest means of obtaining a ready vacuum, in consequence of its property of rapid condensation on the application of cold: its other property of extraordinary expansion, which had first attracted to it the attention of mechanicians, and presented in reality a much more obvious application of it as a mechanical agent, had been entirely neglected. The only improvements of the engine which were attempted or thought of were such as referred to what may be called its subordinate mechanism, that is to say, the contrivances for facilitating the alternate supplies of the steam and the water on which its action depended; and after Mr. Beighton had, about the year 1718, made the machine itself shut and open the cocks by which these supplies were regulated, instead of having that service performed, as at first, by an attendant, there remained little more to be done even in this department. The steam might be applied with more ease and readiness, but not with any augmentation of effect;

the power of the engine could be increased only by a more plentiful application of atmospheric pressure. It was with propriety, therefore, that Newcomen's invention was called, not a steam, but an atmospheric, engine.

For half a century, accordingly, after the improvements introduced by Beighton, who may be considered as the perfecter of this engine, no further progress worth mentioning was made in the application of steam as an agent in mechanics. The engine itself was more and more extensively employed, notwithstanding its defects; but no better method was proposed of calling into exercise the stupendous powers of the element which, by means of only one of its remarkable properties, was here shown to be capable of rendering such valuable service. Our knowledge of what might be done by steam was in this state when the subject at last happily attracted the attention of Mr. Watt.

JAMES WATT was born at Greenock on the 19th of January, 1736. His father was a merchant, and also one of the magistrates, of that town. He received the rudiments of his education in his native place; but, his health being even then extremely delicate, as it continued to be to the end of his life, his attendance at school was not always very regular. He amply made up, however, for what he lost in this way by the diligence with which he pursued his studies at home, where without any assistance he succeeded at a very early age in making considerable proficiency in various branches of knowledge. Even at this time his favourite study is said to have been mechanical science, to a love of which he was probably in some degree led by the example of his grandfather and his uncle, both of whom had been teachers of the mathematics, and had left a considerable reputation for learning and ability in that department. Young Watt, however, was not indebted to any instructions of theirs for his own acquirements in science, the

former having died two years before, and the latter the year after, he was born. At the age of eighteen he was sent to London to be apprenticed to a maker of mathematical instruments; but in little more than a year the state of his health forced him to return to Scotland; and he never received any further instruction in his profession. A year or two after this, however, a visit which he paid to some relations in Glasgow suggested to him the plan of attempting to establish himself in that city in the line for which he had been educated. In 1757, accordingly, he removed thither, but, not being a burgess, was prevented from opening a shop within the limits of the burgh by the Incorporation of Trades; on which he was immediately appointed mathematical instrument maker to the College. In this situation he remained for some years, during which, notwithstanding almost constant ill health, he continued both to prosecute his profession, and to labour in the general cultivation of his mind, with extraordinary ardour and perseverance. Here also he enjoyed the friendship and intimacy of several distinguished persons who were then members of the University, especially of the celebrated Dr. Black, the discoverer of the principle of latent heat, and Mr. (afterwards Dr.) John Robison, so well known by his treatises on mechanical science, who was then a student and about the same age with himself. Honourable, however, as his present appointment was, and important as were many of the advantages to which it introduced him, he probably did not find it a very lucrative one; and, therefore, in 1763, when about to marry, he removed from his apartments in the University to a house in the city, and entered upon the profession of a general engineer.

For this his genius and scientific attainments admirably qualified him. Accordingly, he soon acquired a high reputation, and was extensively employed in making surveys and estimates for canals, harbours,

bridges, and other public works. His advice and assistance indeed were sought for in almost all the important improvements of this description which were now undertaken or proposed in his native country. But another pursuit, in which he had been for some time privately engaged, was destined ere long to withdraw him from this line of exertion, and to occupy his whole mind with an object still more worthy of its extraordinary powers.

While yet residing in the College his attention had been directed to the employment of steam as a mechanical agent by some speculations of his friend Mr. Robison, with regard to the practicability of applying it to the movement of wheel-carriages; and he had also himself made some experiments with Papin's digester, with the view of ascertaining its expansive force. He had not prosecuted the inquiry, however, so far as to have arrived at any determinate result, when in the winter of 1763-4, a small model of Newcomen's engine was sent to him by the Professor of Natural Philosophy to be repaired and fitted for exhibition in the class. The examination of this model set Watt upon thinking anew, and with more interest than ever, on the powers of steam.

The first thing that attracted his attention about the machine before him, the cylinder of which was only of two inches' diameter, while the piston descended through six inches, was the insufficiency of the boiler, although proportionably a good deal larger than in the working engines, to supply the requisite quantity of steam for the creation of the vacuum. In order to remedy this defect he was obliged, in repairing the model, to diminish the column of water to be raised; in other words, to give the piston less to do, in compensation for its having to descend, not through a perfect vacuum, but in opposition to a considerable residue of undisplaced air. He also soon discovered the reason why in this

instance the steam sent up from the boiler was not sufficient to fill the cylinder. In the first place, this containing vessel, being made, not of cast-iron, as in the larger engines, but of brass, abstracted more of the heat from the steam, and so weakened its expansion; and secondly, it exposed a much larger surface to the steam, in proportion to its capacity, than the cylinders of the larger engines did, and this operated still more strongly to produce the same effect. Led by the former of these considerations, he made some experiments in the first instance with the view of discovering some other material whereof to form the cylinder of the engine which should be less objectionable than either brass or cast-iron; and he proposed to substitute wood, soaked in oil, and baked dry. But his speculations soon took a much wider scope; and, struck with the radical imperfections of the atmospheric engine, he began to turn in his mind the possibility of employing steam in mechanics in some new manner which should enable it to operate with much more powerful effect. This idea having got possession of him, he engaged in an extensive course of experiments, for the purpose of ascertaining as many facts as possible with regard to the properties of steam; and the pains he took in this investigation were rewarded with several valuable discoveries. The rapidity with which water evaporates, he found, for instance, depended simply upon the quantity of heat which was made to enter it; and this again on the extent of the surface exposed to the fire. He also ascertained the quantity of coals necessary for the evaporation of any given quantity of water, the heat at which water boils under various pressures, and many other particulars of a similar kind which had never before been accurately determined.

Thus prepared by a competent knowledge of the properties of the agent with which he had to work, he next proceeded to take into consideration, with a view to their

amendment, what he deemed the two grand defects of Newcomen's engine. The first of these was the necessity, arising from the method employed to concentrate the steam, of cooling the cylinder, before every stroke of the piston, by the water injected into it. On this account a much more powerful application of heat than would otherwise have been requisite was demanded for the purpose of again heating that vessel when it was to be refilled with steam. In fact, Watt ascertained, that there was thus occasioned, in the feeding of the machine, a waste of not less than three-fourths of the whole fuel employed. If the cylinder, instead of being thus cooled for every stroke of the piston, could be kept permanently hot, a fourth part of the heat which had been hitherto applied would be found to be sufficient to produce steam enough to fill it. How, then, was this desideratum to be attained? De Caus had proposed to effect the condensation of the steam by actually removing the furnace from under the boiler before every stroke of the piston; but this, in a working engine, evidently would have been found quite impracticable. Savery, the first who really constructed a working engine, and whose arrangements, as we have already remarked, all showed a very superior ingenuity, employed the method of throwing cold water over the outside of the vessel containing his steam—a perfectly manageable process, but at the same time a very wasteful one; inasmuch as, every time it was repeated, it cooled not only the steam, but the vessel also, which, therefore, had again to be heated, by a large expenditure of fuel, before the steam could be reproduced. Newcomen's method of injecting the water into the cylinder was a considerable improvement on this; but it was still objectionable on the same ground, though not to the same degree; it still cooled not only the steam, on which it was desired to produce that effect, but also the cylinder itself, which, as the vessel in which more steam was to be immediately manu-

factured, it was so important to keep hot. It was also a very serious objection to this last-mentioned plan, that the injected water itself, from the heat of the place into which it was thrown, was very apt to be partly converted into steam; and, the more cold water was used, the more considerable did this creation of new steam become. In fact, in the best of Newcomen's engines, the perfection of the vacuum was so greatly impaired from this cause, that the resistance experienced by the piston in its descent was found to amount to about a fourth part of the whole atmospheric pressure by which it was carried down, or, in other words, the working power of the machine was thereby diminished one-fourth.

After reflecting for some time upon all this, it at last occurred to Watt to consider whether it might not be possible, instead of continuing to condense the steam in the cylinder, to contrive a method of drawing it off, to undergo that operation in some other vessel. This fortunate idea having presented itself to his thoughts, it was not very long before his ingenuity also suggested to him the means of realizing it. In the course of one or two days, according to his own account, he had all the necessary apparatus arranged in his mind. The plan which he devised, indeed, was an extremely simple one, and on that account the more beautiful. He proposed to establish a communication by an open pipe between the cylinder and another vessel, the consequence of which evidently would be, that when the steam was admitted into the former, it would flow into the latter so as to fill it also. If then the portion in this latter vessel only should be subjected to a condensing process, by being brought into contact with cold water, or any other convenient means, what would follow? Why, a vacuum would be produced here—into that, as a vent, more steam would immediately rush from the cylinder—that likewise would be con-

densed—and so the process would go on till all the steam had left the cylinder, and a perfect vacuum had been effected in that vessel, without so much as a drop of cold water having touched or entered it. The separate vessel alone, or the Condenser, as Watt called it, would be cooled by the water used to condense the steam—and that, instead of being an evil, manifestly tended to promote and quicken the condensation. When Watt reduced these views to the test of experiment, he found the result to answer his most sanguine expectations. The cylinder, although emptied of its steam for every stroke of the piston as before, was now constantly kept at the same temperature with the steam (or 212° Fahrenheit); and the consequence was, that one-fourth of the fuel formerly required sufficed to feed the engine. But, besides this most important saving in the expense of maintaining the engine, its power was greatly increased by the more perfect vacuum produced by the new construction, in which the condensing water, being no longer admitted within the cylinder, could not, as before, create new steam there while displacing the old. The first method which Watt adopted of cooling the steam in the condenser was to keep that vessel surrounded by cold water—considering it as an objection to the admission of the water into its interior, that it might be difficult in that case to convey it away as fast as it would accumulate. But he found that the condensation was not effected in this manner with so much rapidity as was desirable. It was necessary for him, too, at any rate to employ a pump attached to the condenser, in order to draw off both the small quantity of water deposited by the cooled steam, and the air unavoidably introduced by the same element—either of which, if allowed to accumulate, would have impaired the perfect vacuum necessary to attract the steam from the cylinder. He therefore determined eventually to admit also the additional quantity of

water required for the business of condensation, and merely to employ a larger and more powerful pump to carry off the whole.

Such, then, was the remedy by which the genius of this great inventor effectually cured the first and most serious defect of the old apparatus. In carrying his ideas into execution, he encountered, as was to be expected, many difficulties, arising principally from the impossibility of realizing theoretical perfection of structure with such materials as human art is obliged to work with; but his ingenuity and perseverance overcame every obstacle. One of the things which cost him the greatest trouble was, how to fit the piston so exactly to the cylinder as, without affecting the freedom of its motion, to prevent the passage of the air between the two. In the old engine this end had been attained by covering the piston with a small quantity of water the dripping down of which into the space below, where it merely mixed with the stream introduced to effect the condensation, was of little or no consequence. But in the new construction, the superiority of which consisted in keeping this receptacle for the steam always both hot and dry, such an effusion of moisture, although only in very small quantities, would have occasioned material inconvenience. The air alone, besides, which in the old engine followed the piston in its descent, acted with considerable effect in cooling the lower part of the cylinder. His attempts to overcome this difficulty, while they succeeded in that object, conducted Watt also to another improvement, which effected the complete removal of what we have called the second radical imperfection of Newcomen's engine, namely, its non-employment, for a moving power, of the expansive force of the steam. The effectual way, it occurred to him, of preventing any air from escaping into the part of the cylinder below the piston, would be to dispense with the use of that element above the

piston, and to substitute there likewise the same contrivance as below, of alternate steam and a vacuum. This was of course to be accomplished by merely opening communications from the upper part of the cylinder to the boiler on the one hand, and the condenser on the other, and forming it at the same time into an air-tight chamber, by means of a cover, with only a hole in it to admit the rod or shank of the piston, which might, besides, without impeding its freedom of action, be padded with hemp, the more completely to exclude the air. It was so contrived, accordingly, by a proper arrangement of the cocks and the machinery connected with them, that, while there was a vacuum in one end of the cylinder, there should be an admission of steam into the other; and the steam so admitted now served not only, by its susceptibility of sudden condensation, to create the vacuum, but also, by its expansive force, to impel the piston. Steam, in fact, was now restored to be, what it had been in the early attempts to use it as a mechanical agent, the moving power of the engine; but its efficiency in this capacity was for the first time both taken full advantage of, by means of contrivances properly arranged for that end, and combined with, and aided by, its other equally valuable property which had alone been called into action in the more recent machines.

These were the great improvements which Watt introduced in what may be called the principle of the steam-engine, or, in other words, in the manner of using and applying the steam. They constitute, therefore, the grounds of his claim to be regarded as the true author of the conquest that has at last been obtained by man over this powerful element. But, original and comprehensive as were the views out of which these fundamental inventions arose, the exquisite and inexhaustible ingenuity which the engine, as finally perfected by him, displays in every part of its subordinate

mechanism is calculated to strike us perhaps with scarcely less admiration. It forms undoubtedly the best exemplification that has ever been afforded of the number and diversity of services which a piece of machinery may be made to render to itself by means solely of the various application of its first moving power, when that has once been called into action. Of these contrivances we may notice one or two, by way of specimen. Perhaps the most remarkable is that called the *governor*. This consists of an upright spindle, which is kept constantly turning, by being connected with a certain part of the machinery, and from which two balls are suspended in opposite directions by rods, attached by joints, somewhat in the manner of the legs of a pair of tongs. As long as the motion of the engine is uniform, that of the spindle is so likewise, and the balls continue steadily revolving at the same distance from each other. But as soon as any alteration in the action of the piston takes place, the balls, if it has become more rapid, fly farther apart under the influence of the increased centrifugal force which actuates them—or approach nearer to each other in the opposite circumstances. This alone would have served to indicate the state of matters to the eye; but Watt was not to be so satisfied. He connected the rods with a valve in the tube by which the steam is admitted to the cylinder from the boiler, in such a way, that, as they retreat from each other, they gradually narrow the opening which is so guarded, or enlarge it as they tend to collapse; thus diminishing the supply of steam when the engine is going too fast, and, when it is not going fast enough, enabling it to regain its proper speed by allowing it an increase of aliment. Again, the constant supply of a sufficiency of water to the boiler is secured by an equally simple provision, namely, by a *float* resting on the surface of the water, which, as soon as it is carried down by the consumption of the water to a

certain point, opens a valve and admits more. And so on through all the different parts of the apparatus, the various wonders of which cannot be better summed up than in the forcible and graphic language of a living writer:—"In the present perfect state of the engine it appears a thing almost endowed with intelligence. It regulates with perfect accuracy and uniformity the *number of its strokes* in a given time, *counting* or *recording* them moreover, to tell how much work it has done, as a clock records the beats of its pendulum;—it regulates the *quantity of steam* admitted to work;—the *briskness of the fire*;—the *supply of water* to the boiler;—the *supply of coals* to the fire;—it *opens and shuts its valves* with absolute precision as to time and manner;—it *oils its joints*;—it *takes out any air* which may accidentally enter into parts which should be vacuous; and, when anything goes wrong which it cannot of itself rectify, it *warns its attendants* by ringing a bell: yet with all these talents and qualities, and even when exerting the power of six hundred horses, it is obedient to the hand of a child;—its aliment is coal, wood, charcoal, or other combustible,—it consumes none while idle,—it never tires, and wants no sleep; it is not subject to malady when originally well made, and only refuses to work when worn out with age; it is equally active in all climates, and will do work of any kind; it is a water-pumper, a miner, a sailor, a cotton-spinner, a weaver, a blacksmith, a miller, &c., &c.; and a small engine, in the character of a *steam poney*, may be seen dragging after it on a railroad a hundred tons of merchandise, or a regiment of soldiers, with greater speed than that of our fleetest coaches. It is the king of machines, and a permanent realization of the *Genii* of Eastern fable, whose supernatural powers were occasionally at the command of man."*

* Arnott's Elements of Physics, fourth edition, vol. i. p. 384.

In addition to those difficulties which his unrivalled mechanical ingenuity enabled him to surmount, Watt, notwithstanding the merit of his inventions, had to contend for some time with others of a different nature, in his attempts to reduce them to practice. He had no pecuniary resources of his own, and was at first without any friend willing to run the risk of the outlay necessary for an experiment on a sufficiently large scale. At last he applied to Dr. Roebuck, an ingenious and spirited speculator, who had just established the Carron ironworks, not far from Glasgow, and held also at this time a lease of the extensive coal-works at Kinneal, the property of the Duke of Hamilton. Dr. Roebuck agreed to advance the requisite funds on having two-thirds of the profits made over to him; and upon this Mr. Watt took out his first patent in the beginning of the year 1769. An engine with a cylinder of eighteen inches' diameter was soon after erected at Kinneal; and, although, as a first experiment, it was necessarily in some respects of defective construction, its working completely demonstrated the great value of Watt's improvements. But Dr. Roebuck, whose undertakings were very numerous and various, in no long time after forming this connexion, found himself involved in such pecuniary difficulties, as to put it out of his power to make any farther advances in prosecution of its object. On this Watt applied himself for some years almost entirely to the ordinary work of his profession as a civil engineer; but at last, about the year 1774, when all hopes of any farther assistance from Dr. Roebuck were at an end, he resolved to close with a proposal which had been made to him through his friend Dr. Small, of Birmingham, that he should remove to that town, and enter into partnership with the eminent hardware manufacturer, Mr. Boulton, whose extensive establishments at Soho had already become famous over Europe, and procured for England an unrivalled reputation for the

arts there carried on. Accordingly, an arrangement having been made with Dr. Roebuck, by which his share of the patent was transferred to Mr. Boulton, the firm of Boulton and Watt commenced the business of making steam-engines in the year 1775.

Mr. Watt now obtained from Parliament an extension of his patent for twenty-five years from this date, in consideration of the acknowledged national importance of his inventions. The first thing which he and his partner did was to erect an engine at Soho, which they invited all persons interested in such machines to inspect. They then proposed to erect similar engines wherever required, on the very liberal principle of receiving as payment for each only one-third of the saving in fuel which it should effect, as compared with one of the old construction. As this saving, however, had been found to amount in the whole to fully three-fourths of all the fuel that had been wont to be employed, the revenue thus accruing to the patentees became very great after their engines were extensively adopted. This they very soon were, especially in Cornwall, where the numerous mines afforded a vast field for the employment of the new power, partly in continuing or commencing works which only an economized expenditure could make profitable, and often also in labours which the old engine was altogether inadequate to attempt.

But the draining of mines was only one of many applications of the steam-power now at his command which Watt contemplated, and in course of time accomplished. During the whole twenty-five years, indeed, over which his renewed patent extended, the perfecting of his invention was his chief occupation; and, notwithstanding a delicate state of health, and the depressing affliction of severe head-aches to which he was extremely subject, he continued throughout this period to persevere with unwearied diligence in adding new im-

provements to the mechanism of the engine, and devising the means of applying it to new purposes of usefulness. He devoted, in particular, the exertions of many years to the contriving of the best methods of making the action of the piston communicate a rotatory motion in various circumstances; and between the years 1781 and 1785 he took out four different patents for inventions having this object in view. In the midst of these scientific labours, too, his attention was much distracted by attempts which were made in several quarters to pirate his improvements, and the consequent necessity of defending his rights in a series of actions, which, notwithstanding successive verdicts in his favour, did not terminate till the year 1799, when the validity of his claims was finally confirmed by the unanimous decision of the Judges of the Court of King's Bench.

Watt's inexhaustible ingenuity displayed itself in various other contrivances beside those which make part of his steam-engine. An apparatus for copying letters and other writings, now in extensive use; a method of heating houses by steam; a new composition, for the purposes of sculpture, having the transparency and nearly the hardness of marble; a machine for multiplying copies of busts and other performances in carving or statuary,—are enumerated among his minor inventions. But it is his steam-engine that forms the great monument of his genius, and that has conferred upon his name its imperishable renown. This invention has already gone far to revolutionize the whole domain of human industry; and almost every year is adding to its power and its conquests. In our manufactures, our arts, our commerce, our social accommodations, it is constantly achieving what, little more than half a century ago, would have been accounted miracles and impossibilities. "The trunk of an elephant," it has been finely and truly said, "that can pick up a pin, or rend an oak, is as nothing to it.

It can engrave a seal, and crush masses of obdurate metal like wax before it,—draw out, without breaking, a thread as fine as gossamer,—and lift a ship of war like a bauble in the air. It can embroider muslin and forge anchors; cut steel into ribands, and impel loaded vessels against the fury of the winds and waves."* But another application of it, which had only begun to be made when the above sketch was originally published, has already been productive of still greater changes on the condition of society than had resulted from any of its previous achievements. It had been employed, several years before, at some of our collieries, in the propelling of heavily-loaded carriages over railways; but the great experiment of the Liverpool and Manchester Railway, opened in September, 1830, for the first time practically demonstrated with what hitherto almost undreamt-of *rapidity* travelling by land might be carried on through the aid of steam. Coaches, under the impetus communicated by this, the most potent, and at the same time the most perfectly controllable of our mechanical agencies, were now drawn forward at the flying speed of thirty and thirty-five miles an hour. Nor did it seem that even this was to be our ultimate limit of attainment. Even in navigation, although there the resistance of the water increases so much more rapidly than the force opposed to it, it was impossible to say what might not yet be accomplished. On land, the thin medium of the air presents no such formidable obstacle to a force making its way through it; and a rapidity of movement might perhaps be eventually attained here, which was as yet inconceivable. But even when the rate of land travelling already shown to be quite practicable should have become universal, in what a new state of society should we find ourselves! When we should be able to travel a hundred miles in any direction in three or four

* Article on Watt by Lord Jeffrey in the *Encyclopædia Britannica.*

hours, into what comparative neighbourhood would the remotest extremes even of a large country be brought, and how little should we think of what we had hitherto called distance! A nation, it was said, will then be indeed a community; and all the benefits of the highest civilization, instead of being confined to one central spot, will be diffused equally over the land, like the light of heaven. This improvement, in short, when fully consummated, will confer upon man nearly as much new power and new enjoyment as if he were actually endowed with wings.

It is gratifying to reflect that, even while he was yet alive, Watt received from the voice of the most illustrious of his contemporaries the honours due to his genius. In 1785 he was elected a Fellow of the Royal Society; the degree of Doctor of Laws was conferred upon him by the University of Glasgow in 1806; and in 1808 he was elected a member of the French Institute. He died on the 25th of August, 1819, in the 84th year of his age.

We cannot better conclude our sketch of the life of this great inventor than by the following extract from the character that has been drawn of him by the eloquent writer (the late Lord Jeffrey) whom we have already quoted. "Independently of his great attainments in mechanics, Mr. Watt was an extraordinary, and in many respects a wonderful man. Perhaps no individual in his age possessed so much and such varied and exact information,—had read so much, or remembered what he had read so accurately and well. He had infinite quickness of apprehension, a prodigious memory, and a certain rectifying and methodizing power of understanding, which extracted something precious out of all that was presented to it. His stores of miscellaneous knowledge were immense, and yet less astonishing than the command he had at all times over them. It seemed as if every subject that

was casually started in conversation had been that which he had been last occupied in studying and exhausting; such was the copiousness, the precision, and the admirable clearness of the information which he poured out upon it without effort or hesitation. Nor was this promptitude and compass of knowledge confined in any degree to the studies connected with his ordinary pursuits. That he should have been minutely and extensively skilled in chemistry and the arts, and in most of the branches of physical science, might perhaps have been conjectured; but it could not have been inferred from his usual occupations, and probably is not generally known, that he was curiously learned in many branches of antiquity, metaphysics, medicine, and etymology, and perfectly at home in all the details of architecture, music, and law. He was well acquainted, too, with most of the modern languages, and familiar with their most recent literature. Nor was it at all extraordinary to hear the great mechanician and engineer detailing and expounding, for hours together, the metaphysical theories of the German logicians, or criticizing the measures or the matter of the German poetry.

"His astonishing memory was aided, no doubt, in a great measure, by a still higher and rarer faculty—by his power of digesting and arranging in its proper place all the information he received, and of casting aside and rejecting, as it were instinctively, whatever was worthless or immaterial. Every conception that was suggested to his mind seemed instantly to take its place among its other rich furniture, and to be condensed into the smallest and most convenient form. He never appeared, therefore, to be at all encumbered or perplexed with the *verbiage* of the dull books he perused, or the idle talk to which he listened; but to have at once extracted, by a kind of intellectual alchemy, all that was worthy of attention, and to have reduced it for his own use to its true value and to its simplest form.

And thus it often happened, that a great deal more was learned from his brief and vigorous account of the theories and arguments of tedious writers than an ordinary student could have derived from the most faithful study of the originals, and that errors and absurdities became manifest from the mere clearness and plainness of his statement of them, which might have deluded and perplexed most of his hearers without that invaluable assistance."

CHAPTER XVI.

SIR RICHARD ARKWRIGHT.—THE COTTON MANUFACTURE.

THE history of the steam-engine, and of him whose inventive genius has made it what it is, may be appropriately followed by some account of an individual, whose rise from a very humble origin to affluence and distinction was the result of his persevering attention to the improvement of the machinery employed in one of the most important branches of our manufactures, and whose name is intimately connected with the recent history of the commercial greatness of this country; we mean the celebrated Sir RICHARD ARKWRIGHT. Arkwright was born on the 23rd of December, 1732, at Preston, in Lancashire. His parents were very poor, and he was the youngest of a family of thirteen children; so that we may suppose the school education he received, if he ever was at school at all, was extremely limited. Indeed, but little learning would probably be deemed necessary for the profession to which he was bred, that of a barber. This business he continued to follow till he was nearly thirty years of age; and this first period of his history is of course obscure enough. About the year 1760, however, or soon after, he gave up shaving, and commenced business as an itinerant dealer in hair, collecting the commodity by travelling up and down the country, and then, after he had dressed it, selling it again to the wig-makers, with whom he very soon acquired the character of keeping a better article than any of his rivals in the same trade. He had obtained possession, too, we are told, of a secret method of dyeing the hair, by which he doubtless con-

trived to augment his profits; and perhaps, in his accidental acquaintance with this little piece of chemistry, we may find the germ of that sensibility he soon began to manifest to the value of new and unpublished inventions in the arts, and of his passion for patent rights and the pleasures of monopoly.

It would appear that his first effort in mechanics, as has happened in the case of many other ingenious men, was an attempt to discover the perpetual motion. It was in inquiring after a person to make him some wheels for a project of this kind, that in the latter part of the year 1767, he got acquainted with a clock-maker of the name of Kay, then residing at Warrington, with whom it is certain that he remained for a considerable time after closely connected. From this moment we may date his entrance upon a new career.

The manufacture of cotton cloths was introduced into this country only towards the end of the seventeenth century; although stuffs improperly called Manchester cottons had been fabricated nearly three centuries before, which, however, were made entirely of wool. It is generally thought that the first attempt at the manufacture of cotton goods in Europe did not take place till the end of the fifteenth century, when the art was introduced into Italy. Before this, the only cottons known had been imported from the East Indies. The manufacture seems to have thriven well even on its first establishment in this country; we are told by a writer whose work appeared in 1641, that the cottons wrought at Manchester were even then "not seldom sent into foreign parts," to be exchanged there, as he intimates, for the raw material.*

The English cottons, for many years after the introduction of the manufacture, had only the weft of cotton; the warp, or longitudinal threads of the cloth, being of

* See *Treasures of Traffic*, by Lewis Roberts, as quoted in Supplement to Encyclopædia Britannica, art. Cotton Manufacture.

linen. It was conceived to be impracticable to spin the cotton with a sufficiently hard twist to make it serviceable for this latter purpose. Although occasionally exported, too, in small quantities, the manufactured goods were chiefly consumed at home. It was not till about the year 1760 that any considerable demand for them arose abroad.

But about this time the exportation of cottons, both to the continent and to America, began to be carried on on a larger scale, and the manufacture of course received a corresponding impulse. The thread had hitherto been spun entirely, as it still continues to be in India, by the tedious process of the distaff and spindle, the spinner drawing out only a single thread at a time. But, as the demand for the manufactured article continued to increase, a greater and greater scarcity of weft was experienced, till at last, although there were 50,000 spindles constantly at work in Lancashire alone, each occupying an individual spinner, they were found quite insufficient to supply the quantity of thread required. The weavers generally, in those days, had the weft they used spun for them by the females of their family; and now "those weavers," says Mr. Guest, in his History of the Cotton Manufacture, "whose families could not furnish the necessary supply of weft, had their spinning done by their neighbours, and were obliged to pay more for the spinning than the price allowed by their masters; and, even with this disadvantage, very few could procure weft enough to keep themselves constantly employed. It was no uncommon thing for a weaver to walk three or four miles in a morning, and call on five or six spinners, before he could collect weft to serve him for the remainder of the day; and when he wished to weave a piece in a shorter time than usual, a new ribbon or gown was necessary to quicken the exertions of the spinner."

It was natural, in this state of things, that attempts should be made to contrive some method of spinning

more effective than that which had hitherto been in use; and, in fact, several ingenious individuals seem to have turned their attention to the subject. Long before this time, indeed, spinning by machinery had been thought of by more than one speculator. A Mr. Wyatt, of Lichfield, is stated to have actually invented an apparatus for that purpose so early as the year 1733, and to have had factories built and filled with his machines, both at Birmingham and Northampton. These undertakings, however, not being successful, the machines were allowed to perish, and no model or description of them was preserved.* There was also a Mr. Laurence Earnshaw, of Mottram, in Cheshire, of whom "it is recorded," says Mr. Baines, in his History of Lancashire,† "that in the year 1753, he invented a machine to spin and reel cotton at one operation, which he showed to his neighbours, and then destroyed it, through the generous apprehension that he might deprive the poor of bread"—a mistake, but a benevolent one.

It was in the year 1767, as we have mentioned, that Arkwright became acquainted with Kay. In 1768 the two friends appeared together at Preston, and immediately began to occupy themselves busily in the erection of a machine for the spinning of cotton-thread, of which they had brought a model with them. They had prevailed upon a Mr. Smalley, who is described to have been a liquor-merchant and painter of that place, to join them in their speculation; and the room in which the machine was fixed was the parlour of the dwelling-house attached to the free grammar-school, the use of which Smalley had obtained from his friend the schoolmaster. At this time Arkwright was so poor, that, an election contest having taken place in the town, of which he was a burgess, it is asserted that his friends or party were

* See Essay on the Cotton Trade, by Mr. Kennedy, Manchester Memoirs, second series, vol. iii.

† Vol. i. p. 115.

obliged to subscribe to get him a decent suit of clothes before they could bring him into the poll-room.* As soon as the election was over, he and Kay left Preston, and, carrying with them their model, betook themselves to Nottingham, the apprehension of the hostility of the people of Lancashire to the attempt he was making to introduce spinning by machinery having, as Arkwright himself afterwards stated,† induced him to take this step. On arriving at Nottingham he first made arrangements with Messrs. Wright, the bankers, for obtaining the necessary supply of capital; but they, after a short time, having declined to continue their advances, he took his model to Messrs. Need and Strutt, stocking-weavers of that place, the latter of whom was a particularly ingenious man, and well-qualified, from his scientific acquirements, of which he had possessed himself under many disadvantages, to judge of the adaptation of the new machinery to its proposed object. An inspection of it perfectly satisfied him of its great value; and he and Mr. Need immediately agreed to enter into partnership with Arkwright, who accordingly, in 1769, took out a patent for the machine as its inventor. A spinning-mill, driven by horse-power, was at the same time erected and filled with the frames; being, unless we include those erected many years before by Mr. Wyatt, the first work of the kind that had been known in this country. In 1771 Arkwright and his partners established another mill at Cromford, in the parish of Wirksworth, in Derbyshire, the machinery in which was set in motion by a water-wheel; and in 1775 he took out a second patent, including some additions which he had made to his original apparatus.

In what we have hitherto related we have carefully confined ourselves to facts which are universally acknowledged; but there are other points of the story that

* Baines's History of Lancashire, vol. ii. p. 481.

† See his Case, 1781.

have been stated in very opposite ways, and have given rise to much doubt and dispute.

The machinery for which Arkwright took out his patents consisted of various parts, his second specification enumerating no fewer than ten different contrivances; but of these the one that was by far of greatest importance was a device for drawing out the cotton from a coarse to a finer and harder-twisted thread, and so rendering it fit to be used for warp as well as weft.* This was most ingeniously managed by the application of a principle which had not yet been introduced in any other mechanical operation. The cotton was in the first place drawn off from the skewers on which it was fixed by one pair of rollers, which were made to move at a comparatively slow rate, and which formed it into threads of the first and coarser quality;† but at a little distance behind the first was placed a second pair of rollers, revolving three, four, or five times as fast, which took it up when it had passed through the others, the effect of which would be to reduce the thread to a degree of fineness so many times greater than that which it originally had. The first pair of rollers might be regarded as the feeders of the second, which could receive no more than the others sent to them; and that, again, could be no more than these others themselves took up from the skewers. As the second pair of rollers, therefore, revolved, we will say, five times for every one revolution of the first pair, or, which is the same thing, required for

* This was, in truth, the principal subject of Arkwright's first patent; and, accordingly, on the great trial (afterwards mentioned) which took place in June, 1785, his opponents accused him of endeavouring unfairly to prolong his first patent by means of his second.

† In Arkwright's apparatus, which was a combination of the carding and spinning machinery, this first part of the process was somewhat modified; but the principle of the two pairs of rollers, the one revolving faster than the other, which forms the peculiarity of the machine, was employed as here described.

their consumption in a given time five times the length of thread that the first did, they could obviously only obtain so much length by drawing out the common portion of cotton into thread of five times the original fineness. Nothing could be more beautiful or more effective than this contrivance; which, with an additional provision for giving the proper twist to the thread, constitutes what is called the water-frame or throstle.*

Of this part of his machinery Arkwright particularly claimed the invention as his own. He admitted, with regard to some of the other machines included in his patent, that he was rather their improver than their inventor; and the original spinning-machine for coarse thread, commonly called the spinning-jenny, he frankly attributed in its first conception to a person of the name of Hargrave, who resided at Blackburn, and who, he said, having been driven out of Lancashire in consequence of his invention, had taken refuge in Nottingham, but, unable to bear up against a conspiracy formed to ruin him, had been at last obliged to relinquish the further prosecution of his object, and died in obscurity and distress.

There were, however, other parties who had an interest as well as Arkwright in these new machines, and who would not allow that any of them were of his invention. As to the principal of them, the water-frame, they alleged that it was in reality the invention of a poor reed-maker, of the name of Highs or Hayes, and that Arkwright had obtained the knowledge of it from his old associate Kay, who had been employed by Highs to assist him in constructing a model of it a short time before Arkwright had sought his acquaintance. Many cotton-spinners, professing to believe this to be the true state of the case, actually used Arkwright's machinery in their factories, notwithstanding the patent by which he had attempted

* So called from its having been originally moved by *water* power.

to protect it; and this invasion of his monopoly was carried to such an extent, that at last he found himself obliged to bring actions against no fewer than nine different parties.*

The first of these, in which a Colonel Mordaunt was defendant, was tried in the Court of King's Bench in July, 1781. Upon this occasion, however, the question as to the originality of the inventions was not mooted, the position taken for the defence being the insufficiency of the specification on which the patent had been obtained; and upon that ground a verdict was given in favour of the defendant. On this result Arkwright abandoned the other eight actions he had raised; and, instead of attempting any longer to maintain his patent in a court of law, published a pamphlet, containing what he called his 'Case,' with a view of inducing the legislature to interfere for his protection. It is proper we should here mention, that, although the first of these actions in 1781, which decided the fate of the others, thus went off without the real merits of the case having been gone into, yet several of the defendants were prepared to dispute the claim of the patentee to the invention of the machines, and that both Highs and Kay had been summoned to give their evidence upon that point, and were actually in court during the trial of the action

* It is asserted, in the article on the Cotton Manufacture, in the Supplement to the sixth edition of the Encyclopædia Britannica, and repeated in a paper on the same subject in the 91st number of the Edinburgh Review, that a trial took place upon the subject of Arkwright's first patent in the year 1772, on which occasion he obtained a verdict establishing its validity. This statement, however, for which no authority is given, appears to be a mistake. No such trial is alluded to in the course of the proceedings in the Court of King's Bench in June and November, 1785, although both that of July, 1781, and that of February, 1785, are repeatedly mentioned; nor is it noticed, we believe, in any of the earlier accounts of Arkwright's machinery. Mr. Guest (who has written a history of the cotton manufacture, which is marked by a somewhat strong dislike to Arkwright) searched the records of the courts of King's Bench, Common Pleas, and Exchequer, for the year 1772, without finding any trace of it.

against Colonel Mordaunt, the former having been brought over from Ireland, where he was then residing, expressly for the occasion.

Arkwright submitted to the verdict that had been given against him for nearly four years; but at last, in February, 1785, he raised a second action, which was tried in the Court of Common Pleas; and, having brought forward several engineers who declared that they could make the machines from the descriptions which he had given in his specification, he obtained a verdict which reinstated him in the enjoyment of his monopoly. Upon this, as on the former occasion, the only question submitted to the jury was that regarding the sufficiency of the specification; although it soon appeared that several of the parties interested were determined not to rest satisfied with a decision of the matter upon that ground alone.

Accordingly, in the month of June, in the same year, a *scire-facias*, an action which is nominally at the suit of the crown, was brought against Arkwright in the Court of King's Bench to repeal the patent, in the trial of which the whole of the question was at last gone into. The principal evidence on which it was attempted to be shown that the water-frame was not invented by Arkwright was that of Highs, of Kay, and of Kay's wife, the substance of which was, that the double rollers had been originally contrived by Highs in the early part of the year 1767, while he was residing in the town of Leigh; that he had employed his neighbour and acquaintance Kay to make a model of a machine for him upon that principle; and that Kay, upon meeting with Arkwright a short time after, at Warrington, had been persuaded by him to communicate to him the secret of Highs's invention, on the understanding, as it would appear, that the two should make what they could of it, and share the advantages between them. The evidence of each of the witnesses corroborated, so far as the case

admitted, that of the others; Highs stating that he had been first informed of the manner in which Arkwright had got possession of his invention by Kay's wife, who, on her part, swore that she recollected her husband making models, first for Highs, and afterwards for Arkwright, although she could not speak with any distinctness to the nature of the machine; while Kay himself acknowledged the treachery of which he had been guilty, and gave a particular account of the manner in which, as he said, Arkwright had contrived to obtain from him the secret of Highs's invention. Highs also stated that, upon meeting with Arkwright in Manchester, some years after he had taken out his patent, he charged him with the source from which he had derived the machine; to which Arkwright said nothing at first, but afterwards remarked that, if any person, having made a discovery, declined to prosecute it, he conceived any other had a right, after a certain time, to take it up and obtain a patent for it, if he chose.

This famous trial lasted from nine o'clock in the morning till half-past twelve at night, and excited the greatest interest, both among those more immediately concerned, and among the public generally. Among the witnesses examined were Mr. Cumming, the well-known watch-maker, Mr. Harrison, the son of the inventor of the marine chronometer, Mr. Darwin, and the since celebrated James Watt. The result was a verdict again invalidating the patent; which, on a motion being made for a new trial, the court refused to disturb. Arkwright after this never took any further steps to vindicate his patent rights. This has led some writers to argue that in all probability he had really obtained the inventions in the manner that Highs and Kay alleged. It is, however, to be remembered that it has been a common fate with those who have been fortunate enough to enrich themselves by their happy inventions to have attempts made to take from them the honour of those

discoveries of the profits of which it is found impossible to deprive them—and that it has seldom, in such cases, been difficult to find some hitherto unheard-of genius to set up his claim to the prior discovery of what, nevertheless, it would appear he scarcely knew the value of, after he had discovered it. In this particular case the other party had a strong interest in setting aside Arkwright's pretensions if they could, and the circumstance of Kay having been connected with Highs before he was employed by him afforded them a tempting foundation on which to erect what they, no doubt, considered a very convenient theory. Then again, as for so much of their allegation as rested upon the evidence of this Kay, it was not entitled to command much attention, since it appeared both that he had some time before quarrelled with Arkwright, and that he must, even by his own account, have acted so perfidious a part in regard to his first friend, Highs, as to deprive him of all claim to be believed in anything he might now choose to assert. Highs's own evidence is undoubtedly what seems to bear strongest against Arkwright; but he, from very natural causes, might have been mistaken as to various points. He appears to have told his story in a very confused and ineffective way—much as if he either did not feel his ground to be very sure, or was not at all aware of the importance of the facts to which he was brought to speak. It is not impossible that, if he actually did invent the machine in question, Arkwright may have also hit upon the same idea about the same time; or may, at least, have been led to it merely by some vague rumour that had got abroad as to what Highs was about—not an unnatural supposition, when we reflect that his operations seem to have been a good deal talked of in the neighbourhood, and that the slightest hint of the principle of the water-frame would have sufficed to put an ingenious man like Arkwright in possession of the whole machine. And this after all gives us, perhaps, the most

natural explanation of his conversation with Highs at Manchester. If he knew that he had really stolen his invention from that person in the manner stated in Kay's evidence, it is not likely that he would have been much disposed to meet him at all; whereas the interview appears to have been arranged by the intervention of a mutual acquaintance, who no doubt had obtained the consent of both parties to his bringing them together. His silence, when Highs charged him with having got possession of his invention, or rather merely noticed the circumstance (for the whole seems to have passed in quite an amicable manner), will depend for its interpretation very much upon the exact words used by Highs, which it is very possible he did not recollect perfectly when he gave his evidence in the Court of King's Bench twelve or thirteen years afterwards. Perhaps he said nothing about Kay at all; but merely remarked in general terms that he had been beforehand with Mr. Arkwright in thinking of the two pairs of rollers which formed so valuable a part of his patent machinery. This was an averment which for anything that Arkwright knew might be true, and which if incorrect he had at any rate no means of refuting;—so that nothing could be more natural than his remaining silent—although he would scarcely, one would think, have taken the thing quite so passively if he had been flatly charged with the base conduct afterwards imputed to him. The observation, again, he is said to have made a little while after is perfectly consistent with this view of the case. He waives the question as to which of the two might have been first in possession of the idea; and contents himself with simply remarking that, however that might be, he conceived any one who had made a discovery which he thought might be turned to advantage was quite entitled to take it up and prosecute it by himself, even though another might also be in possession of it, if that other showed no intention of stirring in the business. And

to this remark Highs, by his own account, quietly assented, although it certainly would have been natural for him to have hinted, if he really had previously advanced the charge which on the trial he said he had, that, whatever a man might do with regard to an invention that was really his own, he could hardly have a right in any circumstances to steal those of other people, and take out a patent for them.

Whatever conclusion may be come to on the subject of Arkwright's claim to the invention of the machinery introduced by him into his spinning factories, it is incontestable that to him alone belongs the merit both of having combined its different parts with admirable ingenuity and judgment, and of having by his unwearied and invincible perseverance first brought it into actual use on anything like an extensive scale, and demonstrated its power and value. The several inventions which his patent embraced, whether they were his own or not, would probably but for him have perished with their authors; none of whom except himself had the determination and courage to face the multiplied fatigues and dangers that lay in the way of achieving a practical exemplification of what they had conceived in their minds, or to encounter any part of that opposition, incredulity, and ridicule, of those disappointments, repulses, losses, and other discouragements, over all of which he at last so completely triumphed. When he set out on this career he was poor, friendless, and utterly unknown. We have already stated that, on his coming with Kay to Preston, he was almost in rags; and it may be added that, when he and Kay made application immediately before this to a Mr. Atherton for some pecuniary assistance to enable them to prosecute their plans, Arkwright's appearance alone was enough to determine that gentleman to have nothing to do with the adventure. Can we have a more exciting example, then, of what a resolute heart may do in apparently the

most hopeless circumstances?—of what ingenuity and perseverance together may overcome in the pursuit of what they are determined to attain? And this is the grand lesson which the history of Arkwright is fitted to teach us—to give ourselves wholly to our object, and never to despair of reaching it. Even after he had succeeded in forming his partnership with Messrs. Need and Strutt, his success was far from being secured. For a long time the speculation was a hazardous and unprofitable one; and no little outlay of capital was required to carry it on. He tells us himself in his 'Case' that it did not begin to pay till it had been persevered in for five years, and had swallowed up a capital of more than twelve thousand pounds. We cannot doubt that it required all Arkwright's dexterity and firmness to induce his partners to persevere with the experiment under this large expenditure and protracted disappointment. But it was the character of the man to devote his whole heart and faculties to whatever he engaged in. Even to the close of his life the management of his different factories was his only occupation, and even amusement. Although he had been from his early years afflicted with severe asthma, he took scarcely any recreation—employing all his time either in superintending the daily concerns of these establishments, which were regulated upon a plan that itself indicated in its contriver no little ingenuity and reach of mind;*

* "The originality and comprehension of Sir Richard Arkwright's mind," says the writer of the article on the Cotton manufacture, in the Supplement to the Encyclopædia Britannica, "were perhaps marked by nothing more strongly than the judgment with which, although new to business, he conducted the great concerns his discoveries gave rise to, and the systematic order and arrangement which he introduced into every department of his extensive works. His plans of management, which must have been entirely his own, since no establishment of a similar nature then existed, were universally adopted by others; and after long experience they have not yet in any material point been altered or improved."

or in adding such improvements to his machinery from time to time as his experience and observation suggested. And thus it was, that from a poor barber he raised himself, not merely to rank and great affluence, but to be the founder of a new branch of national industry, destined in a wonderfully short space of time to assume the very first place among the manufactures of his country. A very short review of what the cotton trade has since become, as compared with its previous state, will show what it owes to Sir Richard Arkwright.

England may be said to have been a manufacturing country for five hundred years, from the time, namely, when the clothiers of Flanders came over in great numbers, and settled themselves in different parts of the kingdom, on the marriage of our Edward III. to Philippa of Hainault. The manufacture of cotton cloth, however, as we have already noticed, was not introduced among us till about the middle of the seventeenth century, and made no extraordinary progress for a hundred years afterwards. As an evidence of the comparatively slight degree of interest which it excited, and of the little ingenuity which was consequently exerted in its improvement, it may be stated that the valuable invention of the fly-shuttle, which was introduced into the woollen manufacture about the year 1738, was not employed in the weaving of cottons till more than twenty years afterwards; up to which period, whenever the web was more than three feet wide, two men were constantly stationed at the loom in which it was wrought, the one to throw the shuttle from right to left, and the other to throw it back from left to right. It was not till the year 1769 that an attempt was made upon any considerable scale to spin cotton thread by machinery: for, whatever may have been done before this time by individuals of mechanical ingenuity in inventing contrivances for that purpose, it is certain that the invaluable improvement in question was really introduced

into the manufacture by Arkwright when he took out his patent and built his first mill.

The consequence has been a revolution in the entire system, not only of our manufactures but of our commerce, such as never had taken place in so short a space of time in any country. About the beginning of the last century, the quantity of cotton wool annually imported into Great Britain did not amount to 1,200,000lbs.; and by the year 1720 it had not increased to much beyond 2,000,000lbs. There are no returns from 1720 to 1771 but the importation had probably gone on increasing during that interval, although at a slow rate. Nor did it make a very rapid progress even for several years after spinning by machinery was introduced, having from 1771 to 1775 averaged only 4,764,589lbs., and for the next five years only 6,706,013lbs. In 1784, the year immediately preceding the final repeal of Arkwright's patent, it amounted to 11,482,083lbs. That event gave a great impulse to the manufacture, the average importation for the next five years having grown to 25,443,270lbs. annually. In 1799 it had risen to 43,379,278lbs., and in 1800 to 56,010,732lbs. In 1817 it was 124,912,968lbs., and in 1843 it actually amounted to the immense quantity of 673,193,116lbs. The average importation of cotton wool into Great Britain may now be stated as amounting to about 600 millions of pounds per annum, or fully three hundred times what it was a century ago, and to more than a hundred and fifty times what it was when Arkwright began to spin,

The whole of this raw material, with the exception of about a fifth or sixth part, is spun into thread, and mostly wrought into cloth, in this country. The Reverend Dr. Cartwright invented his power-loom in 1784; but it is only since the commencement of the present century that weaving by machinery has become general. Steam was first applied as the moving power for the spinning machinery in 1785; in which year

Messrs. Boulton and Watt erected one of their rotative engines for a factory belonging to the Messrs. Robinson at Paplewick, in Nottinghamshire. In the present day the cotton is carded, spun, and woven into cloth in the same manufactory; these different operations being performed by machinery the several parts of which are all set in motion by a single steam-engine.

In 1787 the number of spinning factories in the county of Lancaster amounted only to 42, of comparatively inconsiderable magnitude; in August 1825, there were, according to Mr. Baines,* no fewer than 104 such factories in Manchester alone, which were worked by 110 steam-engines, of the aggregate power of 3,598 horses. The total number of steam-looms at work in the kingdom in 1835 was 109,626.† In 1824, it has been stated,‡ the number of spindles constantly in motion was about six millions, and the power by which they were moved equal to that of 10,572 horses. In another statement, however, drawn up by Mr. Kennedy,§ it is calculated that in 1817 (when the importation of cotton wool was not nearly so great as in 1824) the number of spindles was 6,645,833, and the moving power equal to that of 20,768 horses. It must be four or five times as great now as it was then. Some idea may be formed of the growth of this manufacture since the year 1769, by contrasting the astonishing number of threads, which it would thus appear are now spun every day, with the 50,000 which were all that were then produced.

The produce of all this machinery is, as may be supposed, immense. "In the present improved state of this (the weaving) process," says the writer of the article already referred to in the Encyclopædia Britannica,

* History of Lancashire, vol. ii. p. 134.

† Returns by Inspectors of Factories, as quoted in Porter's Progress of the Nation, iii. 163.

‡ Supp. to Encyc. Brit., art. Cotton Manufacture.

§ Manchester Memoirs, Second Series, vol. iii.

"one person, generally a girl, attends to two looms, the weekly produce of which is from seven to nine pieces of cloth, of seven eighths wide, and twenty-eight yards long." "A single factory in Manchester," says Mr. Guest, writing in 1828, "and that not of first-rate magnitude, receives the raw cotton, and turns out a web of cloth, varying in width from three quarters of a yard to a yard and a quarter, of forty miles in length every week." In 1750, it has been calculated, the whole amount of the cotton manufacture of the kingdom did not exceed the annual value of 200,000*l.*: it now probably amounts, even after an immense reduction of prices, to between thirty and forty millions of pounds sterling per annum. Sir Richard Arkwright states in his 'Case' published in 1781, that the capital then invested in buildings and machinery by those engaged in this trade amounted to 200,000*l.*; even in 1827 it was calculated to amount, in Lancashire alone, which possesses about four-fifths of the trade, to 8,000,000*l.** In the year ending on the 1st of May 1818, 105 millions of yards of cotton cloth of all sorts were manufactured in Glasgow and the neighbourhood, of which the value was about 5,200,000*l.*† Of this about one-half was exported. The declared, or real, value of the cotton cloths, twist, and yarn, exported from Great Britain in 1843 exceeded 23,000,000*l.* The export trade in cotton is now more than three times that in woollens, the manufacture of which used to be the great staple of the kingdom.

The extraordinary perfection to which every part of the cotton manufacture has now been carried is another result for which we are entirely indebted to the introduction of machinery. Especially since the invention of the mule, a compound of the jenny and the water-frame, about the year 1790, the muslins manufactured in England have been every year attaining a greater fine-

* Baines's Lancashire, vol. ii. p. 134.

† Encyc. Brit. Supp. vol. iii. p. 404.

ness of fabric, and are now rapidly approaching to a rivalry even in this respect with the most exquisite productions of the East. As an illustration of the state of advancement to which the spinning process has been brought, it may be mentioned, that "Mr. John Pollard, of Manchester, spun, in 1792, on the mule, no fewer than 278 hanks of yarn, forming a thread of 233,520 yards, or upwards of 132 miles in length, from a single pound of raw cotton." * The diminution in the price of the manufactured article which has been produced by the successive improvements in the cotton machinery is equally extraordinary. Yarn of what is called No. 100, which even in 1786, after its price had been greatly reduced by the cancelling of Arkwright's patent, sold for thirty-eight shillings, was in 1832 to be had for less than three shillings. The raw material is now indeed brought from India, and manufactured into cloths in England, which, after being re-exported to that country, are actually sold there cheaper than the produce of the native looms. There can hardly be a more striking proof than this of the triumph of machinery.

Finally, it appears that, while the number of persons employed in the cotton manufacture in 1767 did not probably amount to 30,000, the number of those now engaged in its different departments can hardly be less than half a million. Even many years ago, indeed, it was calculated by some authorities to be twice as great.† Yet, "in some branches of the business," it has been stated, "the spinning in particular, such is the economy of labour introduced by the use of machinery, that one man and four children will spin as much yarn as was spun by six hundred women and girls fifty years ago."‡

* Edinburgh Review, No. 91, p. 15.

† Edinburgh Review, No. 91.

‡ Baines's Lancashire, vol. i. p. 119.

CHAPTER XVII.

INVENTION OF THE POWER-LOOM:—DR. CARTWRIGHT. W. EDWARDS.—R. WALKER.



DR. CARTWRIGHT.

Machinery, in addition to being used in the spinning, is also, as we have stated, extensively applied to the weaving of cotton; and we shall now give a short account of the Reverend Dr. Cartwright, to whose ingenuity our great national manufacture is indebted for the introduction of this crowning improvement. The story, besides its connexion with what has gone immediately before, and its own interest, will be found not to be wanting in appropriateness with reference to our general subject; and we have been supplied with the materials of our sketch from a quarter which enables us to add some original and authentic particulars to what has been elsewhere published.

Edmund Cartwright was born in the year 1743, and was the fourth son of William Cartwright, Esq., of Marnham, in Nottinghamshire. One of his elder brothers was the late Major John Cartwright, so well known for his steady devotion through a long life to what he believed to be the cause of truth and patriotism, and for many public and private virtues which commanded the respect even of those who differed most widely from him in politics. Being intended for the church, Edmund at the usual age was entered of University College, Oxford, from whence he was subsequently elected a Fellow of Magdalen College. He early distinguished himself by his literary attainments, an evidence of which he gave to the world while yet a young man, by the publication of a small volume of Poems, which was very favourably received. About the year 1774, also, he became a contributor to the Monthly Review; and he continued to be a frequent writer in that publication during the following ten years.

For the first forty years of his life he had never given any attention to the subject of mechanics; although, as was recollected long afterwards, his genius for invention in that department had once displayed itself, while at his father's house during one of his college vacations, in some improvements which he made on an agricultural machine which happened to attract his notice. But this exercise of his ingenuity, being out of the line of his pursuits at that time, led to no other attempts of the kind, nor to any further application of his thoughts to such matters.

The circumstances which many years after this led him to the invention of his weaving-machine, or power-loom, as it is commonly called, cannot be better described than they have been by himself in the following statement,—first printed (in 1815) in the Supplement to the Encyclopædia Britannica. "Happening," he says, "to be at Matlock in the summer of 1784, I fell in

company with some gentlemen of Manchester, when the conversation turned on Arkwright's spinning-machinery. One of the company observed that as soon as Arkwright's patent expired, so many mills would be erected, and so much cotton spun, that hands would never be found to weave it. To this observation I replied, that Arkwright must then set his wits to work to invent a weaving-mill. This brought on a conversation upon the subject, in which the Manchester gentlemen unanimously agreed that the thing was impracticable; and in defence of their opinion they adduced arguments which I was certainly incompetent to answer, or even to comprehend, being totally ignorant of the subject, having never at the time seen a person weave. I controverted, however, the impracticability of the thing by remarking that there had been lately exhibited in London an automaton figure which played at chess. Now you will not assert, gentlemen, said I, that it is more difficult to construct a machine that shall weave, than one that shall make all the variety of moves that are required in that complicated game. Some time afterwards a particular circumstance recalling this conversation to my mind, it struck me that, as in plain weaving, according to the conception I then had of the business, there could be only three movements, which were to follow each other in succession, there could be little difficulty in producing and repeating them. Full of these ideas, I immediately employed a carpenter and smith to carry them into effect. As soon as the machine was finished I got a weaver to put in the warp, which was of such materials as sail-cloth is usually made of. To my great delight, a piece of cloth, such as it was, was the produce. As I had never before turned my thoughts to mechanism, either in theory or practice, nor had seen a loom at work, nor knew anything of its construction, you will readily suppose that my first loom must have been a most rude piece of machinery. The

warp was laid perpendicularly, the reed fell with a force of at least half-a-hundred weight, and the springs which threw the shuttle were strong enough to have thrown a Congreve rocket. In short it required the strength of two powerful men to work the machine, at a slow rate, and only for a short time. Conceiving in my simplicity that I had accomplished all that was required, I then secured what I thought a most valuable property by a patent, 4th of April, 1785. This being done, I then condescended to see how other people wove; and you will guess my astonishment when I compared their easy modes of operation with mine. Availing myself, however, of what I then saw, I made a loom in its general principles nearly as they are now made. But it was not till the year 1787 that I completed my invention, when I took out my last weaving patent, August the 1st of that year."

Dr. Cartwright's children still remember often seeing their father about this time walking to and fro apparently in deep meditation, and occasionally throwing his arms from side to side; on which they used to be told that he was thinking of weaving and throwing the shuttle. From the moment, indeed, when his attention was first turned to the invention of the power-loom, mechanical contrivance became the grand occupying subject of his thoughts. With that sanguineness of disposition which seems to be almost a necessary part of the character of an inventor, he looked upon difficulties, when he met with them in any of his attempts, as only affording his genius an occasion for a more distinguished triumph; nor did he allow even repeated failures for a moment to dishearten him. Some time after he had brought his first loom to perfection, a manufacturer, who had called upon him to see it at work, after expressing his admiration of the ingenuity displayed in it, remarked that, wonderful as was Mr. Cartwright's mechanical skill, there was one thing that would effectually

baffle him, the weaving, namely, of patterns in checks, or, in other words, the combining, in the same web, of a pattern, or fancy figure, with the crossing colours which constitute the check. Mr. Cartwright made no reply to this observation at the time; but some weeks after, on receiving a second visit from the same person, he had the pleasure of showing him a piece of muslin, of the description mentioned, beautifully executed by machinery. The man is said to have been so much astonished, that he roundly declared his conviction that some agency more than human must have been called in to assist on the occasion.

After this Dr. Cartwright exercised his ingenuity in a variety of other contrivances; and introduced valuable improvements in the combing of wool by machinery, in rope-making, and in several other departments of agriculture and manufactures. For some of these inventions he took out patents, and for others premiums were bestowed upon him by the Society for the Encouragement of Arts, and the Board of Agriculture. Even the steam-engine engaged his attention; and an account of some improvements which he proposed in its mechanism may be found in Rees's Cyclopedia. Indeed, so long as between sixty and seventy years ago, while resident at Eltham in Lincolnshire, he used frequently to tell his son that, if he lived to be a man, he would see both ships and land-carriages impelled by steam. At that early period he had constructed a model of a steam-engine attached to a barge, which he explained about the year 1793, in the presence of his family, to Robert Fulton, then a student of painting under his countryman West, and whose zeal and activity afterwards, as is well known, brought the project of steam-navigation to such perfection in America, from whence it has extended all over the civilized world. Even so late as the year 1822, Dr. Cartwright, notwithstanding his very advanced age, and although his attention was

much occupied by other philosophical speculations, was actively engaged in endeavouring to contrive a plan for propelling land-carriages by steam.



ROBERT FULTON.

His death, however, at Hastings, in October, 1823, prevented the completion of this, as well as of many other designs in the prosecution of which he had been employed. His enthusiasm for mechanical invention continued unabated to the last; and indeed his general energy both of mind and body was very little impaired up to within a short period of his death. In a letter to his brother, Major Cartwright, dated 24th April, 1819, he says:—"I this day entered into my 77th year in as good health and spirits, thank God, as I have done on any one birth-day for the last half century. I am moving about my farm from eight o'clock in the morning till four in the afternoon without suffering the least fatigue. I sent in my claim to the Board of Agriculture for their premium for a cure of the mildew on wheat, but have not yet heard that it was admitted. I don't know whether I ever mentioned to you a machine for

dibbling or planting wheat, which I have brought to great perfection. I have also a very material improvement on the stocks respecting ploughs and wheel-carriages: but of this I shall say nothing till I have brought it to the proof, which I hope to do very shortly; when you shall be immediately informed of the result, whether favourable or not." The following verses, also, which he sent to a friend not long before his death, will show at once the undiminished ardour and activity of his mind, and the generous and philanthropic motives by which his enthusiasm was sustained and directed:—

"Since even Newton owns that all he wrought
Was due to industry and patient thought,
What shall restrain the impulse which I feel
To forward, as I may, the public weal?
By his example fired, to break away,
In search of truth, through darkness into day?
He tried, on venturous wing, the loftiest flight,
An eagle soaring to the fount of light!
I cling to earth, to earth-born arts confined,
A worm of science of the humblest kind.
Our powers, though wide apart as earth and heaven,
For different purposes alike were given:
Though mine the arena of inglorious fame,
Where pride and folly would the strife disdain,
With mind unwearied still will I engage
In spite of failing vigour and of age,
Nor quit the combat till I quit the stage,
Or, if in idleness my life shall close,
Let well-earned victory justify repose!"

The disposition of this excellent man, indeed, naturally carried him throughout his life to promote, by every means in his power, the benefit of his fellow-creatures; and the following fact is perhaps worthy of being recorded, as illustrating how this tendency used to display itself in other parts of his conduct, as well as in his zeal for mechanical improvements. While he held the living of Goadly Maxwood, in Leicestershire, he

applied himself so assiduously to the study of medicine that he acquired extensive knowledge and eminent skill in that science, and was in the habit of prescribing to his poorer parishioners with great success. On one occasion, having made a visit of charity to a poor family, one of the members of which, a boy, lay apparently expiring of putrid fever, he observed that the process of brewing was going on in another apartment of the cottage. On this the antiseptic qualities of yeast instantly occurred to his recollection; and, in his anxiety to save the boy's life, he desired his mother to give him as much yeast as could be forced down his throat. This was scarcely done, when he became somewhat alarmed at his own precipitancy; but he said nothing, and left the cottage. He was immediately after this obliged to go from home for a few days on business, and during his absence he was continually haunted with the thought of the poor boy; but on his return he found, to his inexpressible delight, that he was both alive and getting better, and that his mother dated the commencement of his recovery from the moment the yeast had been administered to him. This anecdote, however, it must be confessed, is certainly more illustrative of the worthy philanthropist's zeal than of his discretion.

Actuated by such feelings as those we have described, Dr. Cartwright was as free as any man who ever lived from jealousy or illiberality towards other inventors. In fact, it may be safely asserted, that, had he not carried his frankness and want of suspicion, as well as his indifference to pecuniary gains, beyond the limits of worldly prudence, his ingenious contrivances would, in all probability, have been productive of much greater benefit to himself than they ever actually were. So careless was he in regard to retaining in his own possession the valuable ideas with which his mind was continually teeming, that he has been frequently known

to have given the most important assistance, by his suggestions, to other persons engaged like himself in mechanical pursuits, and afterwards to have forgotten the circumstance as entirely as if it had never happened. Nay, so completely did what he was engaged about at the moment occupy his mind, that he sometimes forgot his own inventions, and other productions, of an older date, even when his attention was particularly called to them. One day one of his daughters having chanced to repeat in his presence some lines from a poem entitled the 'Prince of Peace,' which appeared in his volume already mentioned, he exclaimed, to her surprise and amusement, "Those are beautiful lines, child; where did you meet with them?" On another occasion, being shown the model of a machine, he examined it with great attention, and at last observed, that the inventor must have been a man of great ingenuity, and that he himself should feel very proud if he had been the author of the contrivance; nor could he be immediately convinced of what was proved to be the case, namely, that it was a machine of his own.

Dr. Cartwright was defrauded of the pecuniary profits which he might reasonably have expected from his great invention of the power-loom by various accidents, and especially by the burning of a manufactory, containing five hundred of his machines, almost immediately after it was built. It may also be added, that, after he had demonstrated the practicability of weaving by machinery, other inventors applied themselves to the devising of contrivances for that purpose slightly different from his —a comparatively easy task, even where the new invention was not merely a disguised infringement of his patent, while in those cases in which it was in reality nothing more than such an infringement it was yet so protected that it could hardly be reached and put down as such. On these and other accounts, and in no small degree owing to Dr. Cartwright's carelessness about his

own interests, the power-loom only began, in point of fact, to be extensively introduced about the year 1801, the very year in which his patent expired. So generally, however, was it felt among those best entitled to express an opinion on the subject that to him really belonged the merit of the invention, that in the year 1808 several merchants and manufacturers of Manchester and its neighbourhood, to none of whom he was personally known, held a meeting to consider the propriety of presenting to the Lords of the Treasury a memorial of his eminent services, and of the losses he had sustained through the piracies and other unfortunate circumstances to which we have alluded. In consequence of this and other applications in his favour, the sum of 10,000*l.* was soon after granted to him by Parliament. This national recognition of his claims may be taken as a sufficient answer to some attempts that have been occasionally made to rob Dr. Cartwright of the credit of having been the author of one of the most valuable presents ever made to the manufacturing industry of his country. The number of power-looms existing in Great Britain (they had scarcely been introduced into Ireland) before the inventor died was probably not much under a hundred thousand.

But as a man of education and literary habits, the inventor of the power-loom, notwithstanding his deviation from his original track of thought and study when he began to give his attention to mechanics, may yet be said to have come even to that new line of pursuit with certain acquired advantages. He brought with him at least a mind awakened to some knowledge of its own powers by the general cultivation it had received, and not undisciplined by its accustomed exercises to habits of speculation and inquiry. The individual we are now to mention, who also rose to eminence in what may be called a department of mechanics, was in these respects very differently circumstanced.

William Edwards, the celebrated Welsh engineer, was born in 1719, in the parish of Eglwysilan, in Glamorganshire. He lost his father, who was a small farmer, when he was only two years old; but his mother continued to hold the farm, and was in this manner enabled to bring up her family, consisting of two other sons and a daughter, beside William, who was the youngest. Her other sons indeed, were soon old enough to take the chief part of her charge off her hands. William, in the mean time, was taught, as he grew up, to read and write Welsh; and this was all the education he seems to have received. When about the age of fifteen he first began to employ himself in repairing the stone fences on the farm; and in this humble species of masonry he soon acquired uncommon expertness. The excellent work he made, and the dispatch with which he got through it, at last attracted the notice of the neighbouring farmers; and they advised his brothers to keep him at this business, and to let him employ his skill, when wanted, on other farms as well as their own. After this he was for some time constantly engaged; and he regularly added his earnings to the common stock of the family.

Hitherto the only sort of building he had practised, or, indeed, had seen practised, was merely with stones without mortar. But at length it happened that some masons came to the parish to erect a shed for shoeing horses near a smith's shop. The operations of these architects were contemplated by William with the liveliest interest, and he used to stand by them for hours while they were at work, taking note of every movement they made. A circumstance that at once struck him was, that they used a different description of hammer from what he had been accustomed to employ; and, perceiving its superiority, he immediately got one of the same kind made for himself. With this he found he could build his walls both a good deal faster and more

neatly than he had been wont to do. But it was not long after he had, for the first time in his life, had an opportunity of seeing how houses were erected that he undertook to build one himself. It was a workshop for a neighbour; and he performed his task in such a manner as obtained him great applause. Very soon after this he was employed to erect a mill, by which he still further increased his reputation as an able and ingenious workman. Mr. Malkin, to whose work on the Scenery, &c. of South Wales, we are indebted for these particulars of Edwards's early life, as well as for the materials of the sequel of our sketch, states that it was while building this mill that the self-taught architect acquired his first knowledge of the principle of the arch.

After this achievement Edwards was accounted the best workman in that part of the country; and, being highly esteemed for his integrity and fidelity to his engagements, as well as for his skill, he had as much employment in his line of a common builder as he could undertake. In his twenty-seventh year, however, he was induced to engage in an enterprise of a much more difficult and important character than anything he had hitherto attempted.

Through his native parish, in which he still continued to reside, flowed the river called the Taff, which, following a southward course, falls at last into the estuary of the Severn. It was proposed to throw a bridge over this river at a particular spot in the parish of Eglwysilan, where it crossed the line of an intended road; but in the way of this design difficulties of a somewhat formidable nature presented themselves, owing both to the great breadth of the water, and the frequent swellings to which it was subject. Mountains covered with wood rose to a considerable height from both its banks; which first attracted and detained every approaching cloud, and then sent down its collected discharge in torrents into the river. Edwards, however, undertook the task

of constructing the proposed bridge, though it was the first work of the kind in which he ever had engaged. Accordingly, in the year 1746, he set to work; and in due time completed a very light and elegant bridge of three arches, which, notwithstanding that it was the work of both an entirely self-taught and an equally untravelled artist, was acknowledged to be superior to anything of the kind in Wales. So far his success had been as perfect as could have been desired. But his undertaking was far from being yet finished. He had in conjunction with some friends given security that the work should stand for seven years; and for two years and a half all went on well. There then occurred a flood of extraordinary magnitude; not only the torrents came down from the mountains in their accustomed channels, but they brought along with them trees of the largest size, which they had torn up by the roots; and these, detained as they floated along by the middle piers of the new bridge, formed a dam there, the waters accumulated behind which at length burst from their confinement and swept away the whole structure. This was no light misfortune in every way to poor Edwards; but he did not suffer himself to be disheartened by it, and immediately proceeded, as his contract bound him to do, to the erection of another bridge, in the room of the one that had been destroyed. He now determined, however, to adopt a very magnificent idea —to span the whole width of the river by a single arch of the unexampled magnitude of one hundred and forty feet from pier to pier. He finished the erection of this stupendous arch in 1751, and had only to add the parapets, when he was doomed once more to behold his bridge sink into the water over which he had raised it, the extraordinary weight of the masonry having forced up the keystones, and, of course, at once deprived the arch of what sustained its equipoise. Heavy as was this second disappointment to the hopes of the

young architect, it did not shake his courage any more than the former had done. The reconstruction of his bridge for the third time was immediately begun with unabated spirit and confidence. Still determined to adhere to his last plan of a single arch, he had now thought of an ingenious contrivance for diminishing the enormous weight which had formerly forced the key-stone out of its place. In each of the large masses of masonry called the haunches of the bridge, being the parts immediately above the two extremities of the arch, he opened three cylindrical holes, which not only relieved the central part of the structure from all over-pressure, but greatly improved its general appearance in point of lightness and elegance. The bridge with this improvement was finished in 1755, having occupied the architect about nine years in all; and it has stood ever since.

This bridge over the Taff—commonly called the *New Bridge*, and by the Welsh *Pont y Pridd*—was, at the time of its erection, the largest stone arch known to exist in the world. Before its erection the Rialto at Venice, the span of which was only ninety-eight feet, was entitled, as Mr. Malkin remarks, to this distinction among bridges; unless, indeed, we are to include the famous aqueduct-bridge at Alcantara, near Lisbon, consisting in all of thirty-five arches, the eighth of which is rather more than a hundred and eight feet in width, and two hundred and twenty-seven in height. The bridge at Alcantara was finished in 1732. Since the erection of the bridge over the Taff several other stone arches of extraordinary dimensions have been built both in our own country and in France—such for instance as the five composing the splendid Pont de Neuilly over the Seine near Paris, the span of each of which is a hundred and twenty-eight feet,—the central arch of the bridge over the same river at Mantes, which is of the same dimensions—the Island Bridge, as it is called, over the

Liffey near Dublin, which is a single arch of a hundred and six feet in width—the bridge over the Tees at Winston, in Yorkshire, which is also a single arch of a hundred and eight feet nine inches wide, and which was built in 1762 by John Johnson, a common mason, at a cost of only five hundred pounds—and the nine elliptical arches, each of a hundred and twenty feet span, forming the magnificent Waterloo Bridge, over the Thames at London. But no one of these great works rivals in respect of dimensions the arch constructed by Edwards.* The bridge over the Taff, we may add, rises to the height of thirty-five feet above the water, and is the segment of a circle of a hundred and seventy feet in diameter. Buttressed as it is at each extremity by lofty mountains, while the water flows in full tide beneath it, its aspect, as it is seen rising into the air, may well be conceived to be particularly striking and grand.

This bridge, which is looked upon as a wonder to this day, spread the fame of Edwards over all the country. He afterwards built many other bridges in South Wales, several of which consisted also of single arches of considerable width, although in no case approaching to that of the arch over the Taff. One which he erected over the Tawy near Swansea, had a span of eighty feet—another at Llandovery in Carmarthenshire was eighty-four feet wide—and a third, Wychbree Bridge, over the Tawy, was of the width of ninety-five feet. All the bridges which Edwards built after his first attempt have their arches formed of segments of much larger circles than he ventured to try in that case; and the roads over them are consequently much flatter, a convenience which amply compensates for their inferiority in point of im-

* A bridge, however, has since been built at Chester, which is the largest single arch in the world, being 200 feet span. A bridge over the Severn, built about twenty-five years ago at Gloucester, is 150 feet span; and the arches of the New London Bridge, completed in 1831, are larger than that of Pont y Pridd.

posing appearance. He found his way to this improvement entirely by his own experience and sagacity; as indeed he may be said to have done to all the knowledge he possessed in his art. Even his principles of common masonry, he used himself to declare, he had learned chiefly from his studies among the ruins of an old Gothic castle in his native parish. In bridge-building the three objects which he always strove to attain in the highest possible degree were, first, durability; secondly, freedom for the passage of the water under the bridge; and lastly, ease of traffic over it.

In commencing architect Edwards did not abandon the business of his forefathers. He was likewise a farmer to the end of his life. Nay, such was his unwearied activity that, not satisfied with his week-day labours in these two capacities, he also officiated on Sundays as pastor to an Independent congregation, having been regularly ordained to that office when he was about thirty years of age, and holding it till his death. He accepted the usual salary from his congregation, considering it right that they should support their minister; but, instead of putting the money into his own pocket, he returned it all, and often much more, in charity to the poor. He always preached in Welsh, although early in life he had also made himself acquainted with the English language, having embraced the opportunity of acquiring it under the tuition of a blind old schoolmaster, in whose house he once lodged for a short time while doing some work at the county town of Cardiff. He is said to have shown all his characteristic assiduity of application in this effort, and to have made a correspondingly rapid progress.

This ingenious and worthy man died in 1789, in the seventieth year of his age, leaving a family of six children, of whom his eldest son David became also an eminent architect and bridge-builder, although he had had no other instruction in his profession than what his

father had given him. David's eldest son is also said to have inherited the genius of his father and his grandfather.

We will take advantage of the mention of Edward's clerical occupation to subjoin a few words respecting another clergyman, the *Wonderful* ROBERT WALKER, as he is still called in the district of the country where he resided, who was curate of Seathwaite in Cumberland during the greater part of last century. The fullest account that has appeared of Mr. Walker is that given, in the notes to his series of sonnets entitled The River Duddon, by Mr. Wordsworth, in whose poem of The Excursion the worthy clergyman is also noticed with the commendation due to his singular virtues. From this memoir we learn that Walker was born in the parish of Seathwaite in 1709; that, being of delicate constitution, it was determined by his parents, whose youngest child he was, to breed him a scholar; and that accordingly he was taught the elements of reading, writing, and arithmetic by the clergyman of the parish, who also officiated as schoolmaster. He afterwards contrived to acquire some knowledge of the classics; and, becoming in this manner qualified for taking holy orders, was ordained and appointed to the curacy of his native parish, which was at this time (about the year 1735) of the value of five pounds per annum. On obtaining possession of this living Walker married, his wife bringing him what he calls himself, in one of his letters, a "fortune" of forty pounds. We must refer to Mr. Wordsworth's pages, and the documents which will be found printed there, for a detail of all that the industry and economy of the curate and his wife contrived to accomplish upon these scanty resources. Suffice it to say that about twenty years after Walker's entrance upon his living we find its value, according to his own statement, increased only to the amount in all of seventeen pounds ten shillings. At a subsequent period it received a further augmentation, to

what amount is not stated; but it was not considerable. Before this Mr. Walker had declined to accept the adjoining curacy of Ulpha, to be held, as proposed by the bishop, in conjunction with that of Seathwaite, considering, as he says himself, that the annexation "would be apt to cause a general discontent among the inhabitants of both places, by either thinking themselves slighted, being only served alternately, or neglected in the duty, or attributing it to covetousness in me; all which occasions of murmuring I would willingly avoid." Yet at this time he had a family of eight or nine children. One of his sons he afterwards maintained at Trinity College, Dublin, till he was ready for taking holy orders. He was, like his predecessors in the same cure, schoolmaster as well as clergyman of his parish; but "he made no charge," says his biographer, "for teaching school; such as could afford to pay gave him what they pleased." His hospitality to his parishioners every Sunday was literally without limitation; he kept a plentiful table for all who chose to come. Economical as he was, no act of his life was chargeable with anything in the least degree savouring of avarice; on the contrary, many parts of his conduct displayed what in any station would have been deemed extraordinary disinterestedness and generosity. Finally, at his death, in 1802, he actually left behind him no less a sum than two thousand pounds.

There is in all this, as Mr. Wordsworth remarks, something so extraordinary as to make some explanatory details necessary. "And to begin," he says, "with his industry; eight hours in each day, during five days in the week, and half of Saturday, except when the labours of husbandry were urgent, he was occupied in teaching. His seat was within the rails of the altar; the communion-table was his desk; and, like Shenstone's schoolmistress, the master employed himself at the spinning-wheel, while the children were repeating their lessons by his

side. Every evening, after school-hours, if not more profitably engaged, he continued the same kind of labour, exchanging, for the benefit of exercise, the small wheel, at which he had sat, for the large one on which wool is spun, the spinner stepping to and fro. Thus was the wheel constantly in readiness to prevent the waste of a moment's time. Nor was his industry with the pen, when occasion called for it, less eager. Entrusted with extensive management of public and private affairs, he acted in his rustic neighbourhood as scrivener, writing out petitions, deeds of conveyance, wills, covenants, &c., with pecuniary gain to himself, and to the great benefit of his employers. These labours, at all times considerable, at one period of the year, viz., between Christmas and Candlemas, when money transactions are settled in this part of the country, were often so intense, that he passed great part of the night, and sometimes whole nights, at his desk. His garden, also, was tilled by his own hand; he had a right of pasturage upon the mountains for a few sheep and a couple of cows, which required his attendance; with this pastoral occupation he joined the labours of husbandry upon a small scale, renting two or three acres in addition to his own less than one acre of glebe; and the humblest drudgery which the cultivation of these fields required was performed by himself. He also assisted his neighbours in haymaking and shearing their flocks, and in the performance of this latter service he was eminently dexterous. They in their turn, complimented him with the present of a haycock, or a fleece; less as a recompense for this particular service than as a general acknowledgment. The Sabbath was in a strict sense kept holy; the Sunday evenings being devoted to reading the Scripture and family prayer. The principal festivals appointed by the Church were also duly observed; but through every other day in the week, through every week in the year, he was incessantly occupied in works

of hand or mind; not allowing a moment for recreation, except upon a Saturday afternoon, when he indulged himself with a newspaper, or sometimes with a magazine. The frugality and temperance established in his house were as admirable as the industry. Nothing to which the name of luxury could be given was there known; in the latter part of his life, indeed, when tea had been brought into almost general use, it was provided for visitors, and for such of his own family as returned occasionally to his roof, and had been accustomed to this refreshment elsewhere; but neither he nor his wife ever partook of it. The raiment worn by his family was comely and decent, but as simple as their diet; the homespun materials were made up into apparel by their own hands. At the time of the decease of this thrifty pair, their cottage contained a large store of webs of woollen and linen cloth, woven from thread of their own spinning. And it is remarkable that the pew in the chapel in which the family used to sit remained a few years ago neatly lined with woollen cloth, spun by the pastor's own hand. It is the only pew in the chapel so distinguished; and I know of no other instance of his conformity to the delicate accommodations of modern times. The fuel of the house, like that of their neighbours, consisted of peat, procured from the mosses by their own labour. The lights by which, in the winter evenings, their work was performed were of their own manufacture, such as still continue to be used in these cottages; they are made of the pith of rushes dipped in fat. *White* candles, as tallow candles are here called, were reserved to honour the Christmas festivals, and were perhaps produced upon no other occasions. Once a month, during the proper season, a sheep was drawn from their small mountain flock, and killed for the use of the family; and a cow, towards the close of the year, was salted and dried for winter provision; the hide was tanned to furnish them with shoes. By these various

resources this venerable clergyman reared a numerous family; not only preserving them, as he affectingly says, "from wanting the necessaries of life," but affording them an "unstinted education, and the means of raising themselves in society."

All this, if not a lesson in the pursuit of knowledge, is at least a striking example of what assiduity and perseverance will do in any pursuit, as well as highly instructive with regard to one of the most important subjects that can engage the attention of literary or scientific students, the art, namely, of husbanding time and employing it to the best advantage. But with all his industry of another description, Mr. Walker did not find it impossible to nourish and exercise also his mental powers. "It might have been concluded," his biographer proceeds, "that no one could thus, as it were, have converted his body into a machine of industry for the humblest uses, and kept his thoughts so frequently bent upon secular concerns, without grievous injury to the more precious parts of his nature. How could the powers of intellect thrive, or its graces be displayed, in the midst of circumstances apparently so unfavourable, and when to the direct cultivation of the mind so small a portion of time was allotted? But, in this extraordinary man, things in their nature adverse were reconciled; his conversation was remarkable, not only for being chaste and pure, but for the degree in which it was fervent and eloquent; his written style was correct, simple, and animated. Nor did his *affections* suffer more than his intellect; he was tenderly alive to all the duties of his pastoral office; the poor and needy 'he never sent empty away;' the stranger was fed and refreshed in passing that unfrequented vale; the sick were visited; and the feelings of humanity found further exercise among the distresses and embarrassments in the worldly estate of his neighbours, with which his talents for business made him acquainted; and the disinterested-

ness, impartiality, and uprightness which he maintained in the management of all affairs confided to him were virtues seldom separated in his own conscience from religious obligations. Nor could such conduct fail to remind those who witnessed it of a spirit nobler than law or custom; they felt convictions which, but for such intercourse, could not have been afforded, that, as in the practice of their pastor there was no guile, so in his faith there was nothing hollow; and we are warranted in believing that, upon these occasions, selfishness, obstinacy, and discord would often give way before the breathings of his good will and saintly integrity. It may be presumed also, while his humble congregation were listening to the moral precepts which he delivered from the pulpit, and to the Christian exhortations, that they should love their neighbour as themselves, and do as they would be done unto, that peculiar efficacy was given to the preacher's labours by recollections in the minds of his congregation, that they were called upon to do no more than his own actions were daily setting before their eyes."

What may be deemed out of character, we may merely add, in some of the occupations in which this excellent clergyman was wont to employ himself ought to be judged of with a reference both to the times in which he was born and grew up, and to the simple and sequestered population among whom it was his lot to pass his life. "Had he lived," says Mr. Wordsworth justly, "at a later period, the principle of duty would have produced application as unremitting; the same energy of character would have been displayed, though in many instances with widely different effects."

CHAPTER XVIII.

PURSUIT OF KNOWLEDGE BY TRAVELLERS:—LITHGOW; WALKING STEWART; ATHENIAN STUART; LEDYARD; BELZONI.—CONCLUSION.

WE have already adverted to the practice which prevailed among the earlier Greek philosophers of seeking knowledge by travelling into foreign parts, and have mentioned Solon, Pythagoras, Democritus, and others, as having resorted to this method of storing their minds with information and enlarging their capacities of thought. Homer himself was traditionally reported to have acquired his various knowledge of mankind and of nature by having actually perambulated the different lands of which he sung. Plato did not open his Academy till he had visited both Italy and Egypt, and come back to his native Athens fraught with all the learning both of the East and the West. Herodotus, the Father of History, spent the greater part of his life in travelling over Egypt, Libya, Assyria, Scythia, Thrace, Macedonia, and the different states and isles of Greece, by way of preparation for his great work, which is filled with descriptions of what its author had seen with his own eyes in these journeyings, and with accounts of transactions and events, the circumstances of which he had collected in the places where they happened. In those days foreign travel offered to a liberal curiosity almost its only opportunity of learning much, either of other countries, or even of some of the most interesting and important branches of scientific knowledge. Now all learning is recorded in books, and books are in the hands of everybody. Whatever new light breaks forth in one country spreads itself in

this way over every other almost as instantaneously as the light of the risen sun over the hemisphere. Books even bring other countries themselves, as it were, home to us, and enable us to make ourselves to a certain extent familiar with them and their inhabitants without crossing our thresholds. But in the days of Plato and Herodotus, this fireside travelling, as it has been quaintly called, was, like many of our other modern luxuries, comparatively unknown. The books that existed were few, and to the generality of people almost as if they did not exist at all. Nor had more than a very small portion even of the philosophic knowledge of which mankind were already in possession been as yet collected, into these convenient depositories. It mostly floated still upon the breath of men's lips, and was to be sought for in distant countries where the living sages dwelt. Thither, therefore, the student repaired as to his university. Nor was the necessity which was thus imposed upon him, of becoming a traveller at the same time that he became a student, without some peculiar advantages, unfavourable as such a condition of things was upon the whole to the rapid and general diffusion of knowledge. It might be a question whether the fabric of philosophy which arose in Greece between the age of Pythagoras and that of Plato may not have been indebted for something of its imposing mould and lineaments of finer beauty to the more extended and varied views of the world and of mankind, which were acquired by its founders and constructors in their extensive wanderings. The abundant supply we now have of the reflected light of books, and its commodiousness for ordinary purposes, have well nigh turned away the eyes of ordinary students from the use and the desire of any other, and abolished altogether from the customary methods of education, both that direct communication of mind with mind, and that intercouse with things themselves instead of the

mere words by which they are dimly shadowed forth, whereby the great thinkers of earliest antiquity were chiefly nurtured. May not the effect be somewhat analogous to what would be produced on the bodily organ of vision by withdrawing it altogether from the natural light of day, and confining it to artificial light?

Books, immense as their value really is, are overrated when it is supposed that they may be made to teach us everything. Many of the items which constitute the mass of human knowledge have not yet found their way into books, but remain still loose and ungathered among the habits and daily transactions of society, or of some particular portion of it, from intercourse with which they are much more easily and perfectly learned than they could be from books, were they actually to be there recorded. But much of what meets us in our direct intercourse with the world, and supplies us with the richest sources of reflection and speculation, does not admit of being transferred to books at all. Indeed what should any one of us know of that country, or portion of society, with which we happen to be most familiar, if all our knowledge of it consisted merely either of what has been, or of what could be, set down about it in books? What mere description, even the most minute and faithful, ever placed before any man an exact representation even of a scene in the world of inanimate nature? The copy, it is true, simply by virtue of its being a copy, may have charms which the reality wants; but that is not the question. The one is something entirely *different* from the other, and produces a different impression upon the mind. Much more must this be the case when the subject of the description is something that, from the more various, complicated, and shifting nature of its relations and lineaments, and from much of its character not showing itself to the eye at all, still less admits of being thrown into the shape of a picture. The moral condition, indeed, of a country and its in-

habitants is constituted by so multifarious a concourse of circumstances, that their number and diversity alone would preclude them from being adequately represented in their working and effect by any description. To be felt and understood in their real power and combined agency, they must be seen and experienced. A general judgment with regard to the matter may undoubtedly be formed from the reports of others; and from such reports also, filled up and coloured by the mind of the reader or hearer, a sufficiently vivid picture of something having a certain resemblance to the original may be drawn; but the real features of that original are nevertheless sure to be in a thousand respects misconceived. Hence with regard to certain subjects, and these neither the least interesting nor the least important to be known, travelling becomes a means of acquiring knowledge, for which in fact there is no substitute. Crowded, too, as is this path of enterprise with so many both of the hazards and the opportunities most alluring to a warm imagination, it is not to be wondered at that it should always have had a peculiar charm for active and adventurous spirits, and that in no other pursuit whatever should greater toils, privations, and dangers have been encountered and overcome.

In the small space that now remains to us we cannot attempt to enumerate many names from the long catalogue of celebrated travellers; but our work would be incomplete without a reference to a few of the most distinguished of those examples which recent times have afforded of this species of devotion in the pursuit of knowledge. There is no other, as we have just remarked, which has sustained men in the endurance of more severe and prolonged suffering, or more frequently tempted them to peril everything, even life itself, in the effort to attain their object.

Some have performed journeys of wonderful extent and difficulty on foot. Of this class is WILLIAM LITH-

gow, who was born in Scotland about the end of the sixteenth century. This person, in a history of his adventures, which he published in 1614, and which has been more than once reprinted, computes the extent of his pedestrian wanderings over various countries in Europe, Asia, and Africa, at no less than thirty-six thousand miles. He underwent many hardships in the course of his peregrinations; but the worst misfortune which befel him was what he suffered in his return home, when he was seized at Malaga, in Spain, by the Inquisition, and subjected both to the ordinary and the extraordinary torture. So dreadfully was he disabled by the injuries he received on this occasion, that after he reached England, and it was proposed that he should make his appearance at Court to present his book to James I., he had to be carried thither on a litter, his worn and emaciated frame exciting the astonishment of all who saw him. Lithgow, who afterwards recovered his health, died in 1640. The late Mr. JOHN STEWART, commonly called Walking Stewart, affords us another instance which deserves to be commemorated under this head. Mr. Stewart had only recently gone out to Madras as a writer in the service of the East India Company, when, in the year 1765, he formed the extraordinary resolution of leaving the Presidency, and setting out to travel on foot over the world. The first thing which he did, in pursuance of this determination, was to write a letter to the Directors, in which he told them that he "was born for higher pursuits than to be a copier of invoices and bills of lading to a company of grocers, haberdashers, and cheesemongers." This heroic epistle, which doubtless not a little amused the persons to whom it was addressed, is said to be still preserved among the records of the Company. Its spirited author lost very little time, after despatching it, in proceeding to execute his project. He first directed his course to Delhi; and he subsequently visited in the

same manner almost every other part of the Indian peninsula, and even extended his excursions to Persia, and, crossing the Red Sea, traversed a considerable portion of the opposite continent of Africa. Finally, he determined to make out the journey to Europe on foot, which he actually accomplished, arriving at length in safety at Marseilles, after surmounting a long succession of difficulties by the most unconquerable perseverance. He then made a tour through Spain, and afterwards walked across France to his native country. But he had not come home, even after all this exertion, to repose from his toils. He soon after set out on a pedestrian perambulation over England, Scotland, and Ireland; and, that finished, he proceeded to the New World, and walked over the greater part of the United States. Such performances will be acknowledged to have amply earned for their author the epithet by which he was distinguished.

Walking Stewart must not be confounded with his contemporary Mr. James Stuart, commonly called Athenian Stuart, from his splendid work entitled 'The Antiquities of Athens,' who, it so happens, is also famous for his travels, a considerable part of which was performed on foot. Indeed, Stuart's life is altogether a fine instance of devotion to the pursuit of knowledge. He was born in London in 1713, and by the early death of his father was left, while yet a boy, to support his mother and her three younger children, by the exercise of his almost uninstructed talents in the humble occupation of painting fans. While sustaining this heavy charge, he found time to study, almost without assistance, not only the higher departments of the art of drawing, but anatomy, geometry, and other branches of science, the knowledge of which he deemed essential to his professional progress as a draftsman and painter. He even taught himself Latin, excited by a desire to understand the inscriptions in that language which he used to see under engravings;

and he afterwards proceeded to the study of Greek. But the knowledge he found in books was insufficient to satisfy him; he could take no rest until he had seen with his own eyes those lands of Italy and Greece of which he had read so much. He therefore made preparations for travel; and let it be recorded to his honour that the first thing he did was to exert himself to obtain situations for his sister and his two younger brothers, which, although humble, might enable them to support themselves and their mother during his absence. An anecdote is also told of him which places in a striking point of view the resolute enthusiasm with which he set out on his enterprise. He had a dangerous wen on his face, which a surgeon whom he consulted advised him to endeavour to get removed before commencing his travels. As the least hazardous mode of treatment, it was at the same time proposed to submit it to a course of medical applications which would occupy a considerable time. Stuart himself, however, immediately asked if an operation could not be attempted. On being informed, in reply, that it certainly might, but that it would be attended with some danger, he reflected a moment, and then, placing himself on a chair, requested the surgeon to proceed immediately to apply the knife; "I," said he, "shall not stir." The operation, fortunately, was performed with perfect success. Stuart then set out on foot, and in this manner accomplished the journey to Rome. He had little or no money in his pocket; but he supported himself on his way by the paintings which he executed and sold. While at Rome he became acquainted with Mr. Revett, the architect, with whom he afterwards proceeded to Greece. It was during a residence of some years in that country that he collected the materials for his great work, already mentioned, which was published in 1762, and immediately introduced its author both to fame and to abundant and lucrative employment in the new profession of

an architect, which he had resolved to embrace. He was afterwards appointed surveyor of Greenwich Hospital, and became a Fellow of the Royal and of the Antiquarian Societies. Mr. Stuart died in 1788.

If our object were to enumerate the important accessions which have been made both to geography and the other sciences by persons who have devoted their lives to travelling, there are many other names of greater eminence which would claim our attention; but, for our particular purpose, we must select our notices with reference, not so much to the positive discoveries which the traveller may have made, as to the spirit of enterprise he has displayed, and the extraordinary sacrifices to which he has submitted for the sake of his object; and, estimated by that criterion, there is perhaps no name that ought in this department of exertion to be placed before that of John Ledyard. Ledyard was born in the year 1751, in Connecticut, in North America. His father, who was the captain of a vessel employed in the West India trade, died at the early age of thirty-five, leaving his widow, with John and three younger children, almost destitute of any means of support. Some time after this, Mrs. Ledyard married again, on which the subject of our notice went to live with his grandfather, who took upon himself the charge of educating and providing for him. The strange and shifting history of his youth we can only sketch very rapidly. After having been kept for some time at a grammar-school in the town of Hartford, where he acquired some acquaintance with the classical tongues, he was sent to a lawyer's office. Here he remained only a few months, when, finding law not at all to his taste, he abandoned the study. He was now nineteen; and he seems to have passed a year or two more of his life in doing nothing. At last, in the beginning of the year 1772, he determined to enter himself a student at a college which had been recently established at Hanover, in

New Hampshire, for the education of missionaries to be employed in converting the Indians. In entering upon this new pursuit, the principal part of his equipment consisted of a collection of dresses and scenery, which he took with him to the college for the purpose of indulging his taste for theatrical amusements, of which he had some time before become passionately fond. After persevering in his studies for four months, he one day, tired of the quiet life he had been leading, left the college, without leave or notice of his intention, and bent his steps to the woods, where he wandered about with the Indians for about three months and a half. He then returned to college; but after a residence of three or four months longer, he again made his escape, this time embarking in a canoe which, with the assistance of some of his fellow-students, he had hollowed out of a large tree, with the intention of descending the Connecticut to Hartford. The distance was not less than a hundred and forty miles, and there were dangerous falls and rapids in many parts of the river; but the intrepid navigator accomplished his voyage without any accident, although, on one occasion, while he lay at his length in his bark, wrapped up in his bear-skin, and absorbed in the perusal, it is uncertain whether of his Greek Testament or his Ovid, the only two books he had taken with him, he very narrowly escaped being sucked down a formidable precipice. His missionary zeal having completely evaporated, his views were now turned to the regular ministry; but, although he began the prescribed preliminary studies, his impatience to be actually engaged in preaching would not allow him to proceed in this course, and he exerted himself, with his characteristic spirit and energy, to carve out, if possible, a shorter road to his object. But we must refer the reader to the very interesting memoirs of his life and travels, published by his countryman Mr. Sparks, for a detail of his various adventures in this pursuit. Suffice

it to say that, after many ridings to and fro, he could not prevail upon the reverend gentleman to whom he applied for immediate ordination to accede to his request. This determined him to bid a final adieu to theology; and, in a few weeks after, he entered himself as a common sailor on board a trading vessel bound to the Mediterranean. He was now for the first time in a line of life suited to his restless and daring character of mind; still, not quite satisfied, he took an opportunity, while the ship was lying at Gibraltar, of leaving it, and enlisting as a soldier. But by the exertions of the captain, who was his friend, his release was obtained from this new engagement; and he returned to the vessel, and completed his voyage back to America. He had no intention, however, of remaining at home. In a letter which he wrote to one of his friends from Gibraltar he had said, "I allot to myself a seven years' ramble more, although the past has long since wasted the means I possessed;" and, in conformity with this resolution, he next set out on a voyage to England, entering himself again as a common sailor on board a vessel bound for Plymouth. From Plymouth he begged his way to London, where he expected to find some relations; but, being unsuccessful in a short search he made after them, he addressed himself to Captain Cook, who, was then (in 1776) setting out on his third and last voyage, and was by him engaged to accompany the expedition in the capacity of a corporal of marines. He was now at last embarked in good earnest on such a *ramble* as he had long been desirous of, and had a chance of seeing something of the world.

In the course of his voyage, Ledyard distinguished himself on various occasions by his activity, courage, and spirit of adventure. At the island of Onalaska, on the north-west coast of America, he was selected by Cook to go alone on an expedition into the interior in quest of a European settlement which there was reason

to believe existed there; and this hazardous commission he executed with great ability and perfect success, having, after a journey of two days, arrived among a small colony of Russians, three of whom he brought back with him to the ship. At Owhyhee his enterprising disposition prompted him, accompanied by two other persons belonging to the expedition, to attempt the ascent of the celebrated volcanic mountain called *Monna Roa*, which has been computed to be about eighteen thousand feet high. After persevering, however, for two days, the party found themselves obliged to return without having reached the summit. The mountain has since been ascended by Lord Byron and several of his officers, when he carried home the bodies of the king and queen of the Sandwich Islands in his majesty's ship Blonde, in 1824-5.* Ledyard also headed the party of marines who were with Captain Cook when he was killed at this island. He continued for two years longer in the navy after returning from his voyage round the world; and then, having found himself in December, 1782, in a man-of-war stationed near New York, he considered it his duty to embrace the opportunity of leaving the service of a country with which his own was now engaged in hostilities. He made his escape, accordingly, from the ship, and returned for a short time to his native village, from which he afterwards transferred himself to Hartford. During four months which he spent here he employed himself in writing an account of his adventures while on board Cook's ship, which was published. Like everything that Ledyard wrote, this work, without much polish of diction, abounds in the traces of a vigorous mind accustomed to suffer no opportunity to pass unimproved of storing itself with materials for reflection. After seeing his book through the press, his old desire of roaming, only made more restless and impatient by the partial gratification it had already

* See his Voyage, pp. 169—191.

enjoyed, roused him again to new schemes and new labours.

His first project was a trading voyage to the north-west coast of his native continent; and he expended much time and exertion in vain endeavours to induce some of his mercantile countrymen to entrust him with the conduct of such an enterprise. He then resolved to repair to Europe, in hopes of better success in that quarter; and, taking ship accordingly, he arrived at Cadiz in August, 1784. From hence he soon after sailed for Brest, and proceeded afterwards to L'Orient, where he intended to announce his plan. At first the persons to whom he had brought letters seemed to enter into his views as warmly as he could desire; and a negotiation was nearly concluded for securing his services to conduct the proposed adventure. After being amused, however, for nearly a year by the expectations thus excited, he was doomed to be again disappointed: some obstacles, of a nature not well ascertained, suddenly presented themselves, and the scheme was abandoned. On this Ledyard proceeded to Paris, where he made himself known to the American minister, Mr. Jefferson, who gave him a very encouraging reception, and exerted himself to promote his object. Here he also met with the celebrated Paul Jones; and that enterprising commander, on being informed by him of his scheme for an expedition to the north-west coast of America, at once agreed to join him in it, and to advance the funds necessary for undertaking it on a large scale; but, after four or five months, this plan also fell to the ground. Hitherto Ledyard had been supported, according to stipulation, by the parties with whom he had successively entered into these fruitless negotiations; but now he was entirely without resources. In this condition he was reduced to the necessity of becoming a pensioner upon the bounty of various distinguished persons whose regard he had acquired, among whom Mr. Jefferson and

the Marquis de la Fayette are particularly mentioned. Meanwhile he made still another attempt to induce a mercantile company to enter into his favourite project; but, after keeping him for several months in suspense, it failed like the others.

Hopeless as he had now become of succeeding in his original plan, he still clung to his determination to find his way, if possible, by some means or other, to the north-west part of the American continent, with the view of exploring that vast and as yet almost unknown region. He resolved, therefore, to attempt the attainment of his object in a new way: namely, by travelling overland to the north-eastern extremity of Asia, through Russia and Siberia, and then crossing Behring's Strait to the quarter he was desirous of reaching. But, while he was making preparations for setting out on this adventure, he was induced suddenly to start for London by a letter from a friend in that city, offering him a free passage in a vessel which was about to sail for the Pacific Ocean, and which would set him on shore at any part of the American coast he might choose. On arriving in the English metropolis he was introduced to Sir Joseph Banks and other eminent scientific characters. His plan of operations was very soon arranged. He determined to land at Nootka Sound, and from thence, penetrating at once into the interior, to make his way across the wilderness to Virginia; but this daring design, like his former attempts, was destined to be frustrated long before he had encountered any of its dangers. The vessel in which he had embarked had sailed down the river and put out to sea, when, just as they were losing sight of land, she was seized and brought back by order of government, in consequence of some irregularity in clearing at the custom-house, and eventually adjudged to be forfeited. On this occasion Ledyard lost all the property he had in the world, which did not, however, amount to much, the principal part of it consisting of two great

dogs, an Indian knife, and a hatchet, which he had purchased with some money given him by the gentleman (Sir James Hall) at whose invitation he had come to London.

On this disappointment he immediately turned his thoughts again to his plan of travelling across Europe and Asia by land; and accordingly, in December, 1786, he set out for Hamburgh, where he arrived with only ten guineas in his pocket, part of the produce of a subscription which had been made for him in London, the remainder of which appears to have been expended in providing himself a second time with a couple of great dogs, and other articles which constituted his simple equipment for a journey across the American continent. Here he heard of a countryman of his own, a Major Langhorn, who was reported to him as having as great a passion for travelling as himself, and who was now at Copenhagen in the course of a perambulation he had been making over the North of Europe. Having reason to suspect that Langhorn was in want of money, the generous Ledyard immediately determined to render him all the succour his own scanty resources would permit. "I will fly to him," says he, in a letter to a friend, "with my little all, and some clothes, and lay them at his feet. At this moment I may be useful to him: he is my countryman, a gentleman, a traveller. He may go with me on my journey: if he does, I am blessed; if not, I shall merit his attention, and shall not be much out of my way to Petersburg." Full of these visions he set out for Copenhagen, where on his arrival he found the person of whom he was in quest, in the predicament he had anticipated, and in so complete a state of destitution, indeed, that he could not leave his room for want of decent clothes. Ledyard's ten guineas soon remedied this inconvenience; and even enabled the two to enjoy a very pleasant fortnight in each other's society. But when Ledyard at last proposed to his friend to ac-

company him to Petersburg, Langhorn's reply was abundantly frank and decisive: "No," said he; "I esteem you, but I can travel in the way I do with no man on earth."

Ledyard therefore, having contrived to recruit his finances by drawing a bill for a few pounds on the secretary to the American embassy in London, which he was fortunate enough to find a person willing to discount, proceeded on his journey alone. When he came to the usual place for crossing the Gulf of Bothnia, he found that his deviation from the direct line of his route in pursuit of Langhorn had lost him his only opportunity of passing over that season; for the winter had turned out what is called an open one, that is to say, the water had not, as it commonly does, frozen all over, so as to form a road for sledges, while at the same time the masses of floating ice made sailing through it impracticable. This was a disappointment which for a moment disconcerted and struck down even Ledyard's courage; but it was only for a moment. To turn back was out of the question; to remain for several months where he was, in inactivity, as little suited his inclination; he therefore resolved to travel round by the northern extremity of the gulf, and so to reach its opposite coast by a journey of above twelve hundred miles through the most desolate regions of the inhabited globe; and all this labour was only to reach a point to which the distance directly across the gulf was not more than fifty miles. He actually accomplished his formidable undertaking in an extraordinarily short space of time, considering the nature of the country through which he had to make his way, having reached Petersburg within seven weeks after leaving Stockholm, which was travelling at the rate of about two hundred miles a-week.

On arriving in Petersburg his money, as might be supposed, was quite exhausted, and even his clothes were torn to pieces. He was again fortunate enough,

however, to obtain twenty guineas by drawing a bill on Sir Joseph Banks, for the payment of which the discounter was willing to depend on that gentleman's generosity. Thus provided he set out for Siberia in company with a Dr. Brown, a Scotch physician, who was going thither on a commission from the government. The travellers proceeded together to Tobolsk, and from thence to Barnaoul, the capital of the province of Kolyvan, where they parted. "How I have come thus far," writes Ledyard from this place to Mr. Jefferson, on the 29th of July, "and how I am to go still farther, is an enigma that I must disclose to you on some happier occasion. My health is perfectly good; but, notwithstanding the vigour of my body, my mind keeps the start of me, and I anticipate my future fate with the most lively ardour. Pity it is, that in such a career one should be subjected, like a horse, to the beggarly impediments of sleep and hunger." After spending a week at Barnaoul, he set out for Irkutsk with the courier who had charge of the mail. Here he remained about ten days, during which time he visited the lake of Baikal, and the other scenery in the neighbourhood. He then proceeded in a boat down the river Lena, and arrived at Yakutsk after a voyage of twenty-two days. This, however, was destined to be the termination of his journey. The Russian government, which at the solicitation of some of his friends in Paris had professed to grant him its protection, and had hitherto forwarded him on his way, is supposed to have been all along determined, nevertheless, that he should not reach the coast of America, where a fur company had been recently established, the concerns of which the national jealousy was unwilling to expose to the inspection of the subject of another state. The commandant at Yakutsk, accordingly, contrived in the first instance to persuade him to remain there during the winter, contrary to his own earnest wishes to proceed, and on representations which he afterwards found to be

quite false. "What, alas! shall I do?" he says in his journal, on finding himself all but detained by force, and not without reason to apprehend that even that might be employed, if necessary, to prevent him from pursuing his journey. "What shall I do, for I am miserably prepared for this unlooked-for delay? By remaining here through the winter, I cannot expect to resume my march until May, which will be eight months. My funds! I have but two long frozen stages more, and I shall be beyond the want or aid of money, until, emerging from the deep deserts, I gain the American Atlantic States; and then, thy glowing climates, Africa, explored, I will lay me down, and claim my little portion of the globe I have viewed: may it not be before." He goes on to lament his poverty as forming, after all, the chief entanglement which had induced him to yield to the commandant's importunities. With regard to his proposed journey, which had been represented to him as impracticable, he says, in a letter to Colonel Smith, "I do not believe it is so, *nor hardly anything else.*" But he adds that he was somewhat reconciled to his detention by one consideration among others, namely, that he was *without clothes, and with only a guinea and one-fourth in his purse.* While at Yakutsk he employed himself diligently in studying the peculiarities of the country and its inhabitants, keeping all the while a regular journal of his observations. It was here that he wrote his celebrated eulogy on woman, which has been so often quoted. But, after he had been a few months at Yakutsk, he was induced to embrace an opportunity which offered of returning up the river in a sledge over the ice to Irkutsk. This journey, of fifteen hundred miles, he accomplished in seventeen days. In four or five weeks after his arrival at Irkutsk he was seized by an order of the Russian government, and immediately despatched in custody to Moscow, from whence he was sent forward in the same condition to Poland, and there set at liberty, with an

intimation that he might now go wherever he pleased, but that, if he ever again set foot in the Russian dominions, he would certainly be hanged. We will leave him to tell the remainder of his story in his own words. "I had penetrated," says he, in his journal, "through Europe and Asia, almost to the Pacific Ocean; but, in the midst of my career, was arrested a prisoner to the Empress of Russia, by an express sent after me for that purpose. I passed under a guard part of last winter and spring; was banished the empire, and conveyed to the frontiers of Poland, six thousand versts from the place where I was arrested, and the journey was performed in six weeks. Cruelties and hardships are tales I leave untold. I was disappointed in the pursuit of an object on which my future fortune entirely depended. I know not how I passed through the kingdoms of Poland and Prussia, or from thence to London, where I arrived in the beginning of May, disappointed, ragged, penniless; and yet so accustomed am I to such things that I declare my heart was whole." His health, he acknowledges, had suffered for the first time from his confinement, and the rapidity with which he had been hurried through Tartary and Russia; but a few days' rest, he adds, in Poland had re-established it, "and I am now," he says, "in as full bloom and vigour as thirty-seven years will afford any man."

When Ledyard found himself in London, one of the first persons on whom he called was his friend Sir Joseph Banks. This gentleman, after hearing from him the story of his disasters, and learning that he had now no particular object in view, told him of the Association which had just been formed, and of which he was himself one of the leading members, for prosecuting discoveries in the interior of Africa. This was news which made Ledyard's heart leap with joy; and having received a letter of introduction from Sir Joseph, he went with it directly to Mr. Beaufoy, the secretary of the

Association. "Before I had learned from the note the name and business of my visitor," said Mr. Beaufoy, "I was struck with the manliness of his person, the breadth of his chest, the openness of his countenance, and the inquietude of his eye. I spread the map of Africa before him, and tracing a line from Cairo to Sennaar, and from thence westward in the latitude and supposed direction of the Niger, I told him, that was the route by which I was anxious that Africa might, if possible, be explored. He said he should think himself singularly fortunate to be trusted with the adventure. *I asked him when he would set out. 'To-morrow morning,' was his answer.*"

It was not possible to get his instructions and letters ready with all the expedition that would have satisfied the wishes of the eager and heroic adventurer. But he at last left London. "Truly it is written," he exclaims in the exultation of his heart in a letter addressed immediately before his departure to his mother, "that the ways of God are past finding out, and his decrees unsearchable. Is the Lord thus great? So also is He good. I am an instance of it. I have trampled the world under my feet, laughed at fear, and derided danger. Through millions of fierce savages, over parching deserts, the freezing North, the everlasting ice, and stormy seas, have I passed without harm. How good is my God! What rich subjects have I for praise, love, and adoration!" To Mr. Beaufoy, the last time they were together, on the morning of his departure, he said, with perhaps a somewhat sadder, but not a less resolute spirit, "I am accustomed to hardships. I have known both hunger and nakedness to the utmost extremity of human suffering. I have known what it is to have food given me as charity to a madman; and I have at times been obliged to shelter myself under the miseries of that character, to avoid a heavier calamity. My distresses have been greater than I have ever owned,

or ever will own to any man. Such evils are terrible to bear; but they never yet had power to turn me from my purpose. If I live, I will faithfully perform, in its utmost extent, my engagement to the Society; and if I perish in the attempt, my honour will still be safe, for death cancels all bonds."

We have little more to relate of poor Ledyard. From London he proceeded to Paris, and from thence to Marseilles, where he took ship for Alexandria. From Alexandria he pursued his journey up the Nile to Cairo, where he arrived on the 19th of August. His intention was to set out at the proper season with the caravan from this city to Sennaar; and in the meantime he occupied himself in studying the character and manners of the people among whom he was, and gaining as much as he could of the information most likely to be useful to him in his future progress. He kept, as usual, a journal of his observations, copious extracts from which have been printed in the Proceedings of the Association. But towards the end of November, when the caravan which he intended to accompany was just on the point of setting out, he was attacked by a bilious complaint; and, after all his hopes, this long looked for opportunity of prosecuting his journey seemed on the point of being lost. In his extreme anxiety in these circumstances to get rid of his indisposition as speedily as possible, he took so large a dose of the common remedy, vitriolic acid, as to produce the most violent pains, which the best medical skill in Cairo was exerted in vain to remove or alleviate; and he perished a victim to his zeal and precipitancy.

There never beat a heart animated by a warmer or more disinterested love of the path of public duty which it had chosen than that which death had now laid low. Mr. Sparks's memoir, to which we have been indebted for the materials of our rapid sketch, contains many other anecdotes of his generous self-devotion which our

space does not permit us to notice. The following passage, however, from a letter addressed to his employers, one of the last he ever wrote, presents so fine a picture of a mind elevated by some of the noblest feelings of which our nature is susceptible that we quote it as a fit conclusion to the account we have given of the writer. "Money!" he exclaims, "it is a vile slave! I have at present an economy of a more exalted kind to observe. I have the eyes of some of the first men of the first kingdom on earth turned upon me. I am engaged by those very men in the most important object that any private individual can be engaged in. I have their approbation to acquire or to lose; and their esteem, also, which I prize above everything, except the independent idea of serving mankind. Should rashness or desperation carry me through, whatever fame the vain and injudicious might bestow, I should not accept of it; it is the good and great I look to; fame bestowed by them is altogether different, and is closely allied to a 'Well done' from God; but rashness will not be likely to carry me through, any more than timid caution. To find the necessary medium of conduct, to vary and apply it to contingencies, is the economy I allude to; and, if I succeed by such means, men of sense in any succeeding epoch will not blush to follow me, and perfect those discoveries which I have only abilities to trace out roughly, or a disposition to attempt. A Turkish sofa has no charms for me: if it had, I could soon obtain one here. Believe me, a single 'Well done' from your Association has more worth in it to me than all the trappings of the East; and what is still more precious is, the pleasure I have in the justification of my own conduct at the tribunal of my own heart."

Ledyard, as is well known, was the first of too long a list of courageous adventurers who have one after another sacrificed their lives in the cause of African discovery; and, did our limits permit, the names of Houghton,

Hornemann, Park, Laing, Clapperton, and many others, might each furnish us with an example, not unworthy to be compared with his, of fearless resolution, and perseverance which only death could overcome. But all that we can attempt now is to sketch very briefly the career of one who, although he also perished in that enterprise, fatal to so many of his forerunners, the attempt to penetrate into central Africa, is and will continue to be chiefly remembered for his researches and discoveries in another quarter of the same great continent; we mean the lamented Belzoni. GIOVANNI BATTISTA BELZONI was born in 1778 at Padua, where his father was a barber. The family, however, had belonged originally to Rome; and it is related that Belzoni, when only thirteen years of age, betrayed his disposition for travelling by setting out one day along with his younger brother to make his way to that city, which he had long been haunted by a passionate desire to see, from hearing his parents so often speak of it. The failing strength and courage of his brother, however, forced him to relinquish this expedition, after they had proceeded as far as the Apennines; and he returned once more to assist his father in his shop, as he had already for some time been doing. But when he was three years older, nothing could detain him any longer in his native place; and he again took the road to Rome, which this time he actually reached. On his first arrival he is said to have applied himself to the acquirement of a knowledge of the art of constructing machines for the conveyance and raising of water, with the view probably of obtaining a livelihood by the exhibition of curious or amusing experiments in that department of physics. It appears, however, that he eventually adopted the profession of a monk, as offering an easier or surer way of gaining his bread.

The conquest of northern Italy by the French in 1800 brought him the opportunity, which he embraced, of

throwing off his monastic habit, heartily tired as he was by this time of the idleness and obscurity to which it consigned him. He led now for some years a wandering life, returning in the first instance to his native town, and then proceeding to Holland, from whence, in about a year afterwards, he came back to Italy. Meanwhile he had attained so uncommon a height, with strength proportioned to it, that he was an object of wonder wherever he was seen. It was probably with the expectation of being able to turn these personal advantages to account that he determined, in 1803, to come over to England. On arriving here, accordingly, he first attempted to gain a maintenance by perambulating the country, exhibiting hydraulic experiments and feats of muscular strength; and, accompanied by his wife, an Englishwoman, whom he had married soon after his arrival, he visited with this object all the principal towns both of Great Britain and Ireland. He was afterwards engaged for some time at Astley's amphitheatre; and altogether he continued for about nine years in England.

At last, seeing no prospect of improving his circumstances in this country, in 1812 he sailed with his wife for Lisbon. Here he soon obtained an engagement from the director of the San Carlos theatre; at the expiration of which he proceeded to Madrid, where for a time he also attracted considerable attention by his performances. From Madrid he went to Malta; and here, it is supposed, the idea first suggested itself to him of passing over to Egypt, as others of his countrymen had already done, and offering his services to the Pasha, the famous Mahomet Ali, himself a model of energy and activity, and the liberal patron of resolution and enterprise. Accordingly, carrying with him a recommendation from a Maltese agent of the Pasha, he proceeded, still accompanied by his wife, to Cairo. On presenting himself to Ali, he was immediately engaged, on the strength of his professed skill in

hydraulics, to construct a machine for watering some pleasure-gardens at Soubra, on the Nile. This undertaking, it is said, he accomplished to the Pasha's satisfaction; but an accident having occurred to one of the persons looking on, on the first trial of the machine, the Turkish superstition, under the notion that what had happened was a bad omen, would not suffer the use of it to be continued. This misfortune, at the same time, put an end to all Belzoni's hopes of further employment from the Pasha; and he was once more probably as much at a loss what to betake himself to as he had ever before been in his life.

The state of destitution, however, in which he found himself, led to his entering upon a new career, in which he was destined to acquire great distinction. The late Mr. Salt was at this time the English consul in Egypt, and, embracing the opportunity which his situation afforded him, was actively employed in investigating and making collections of the precious remains of antiquity in which that country abounded. For this purpose he kept several agents in his pay, whose employment it was to make researches in all directions after interesting objects of this description. To Mr. Salt Belzoni now offered his services in this capacity; and he was immediately employed by that gentleman in an affair of considerable difficulty, namely, the removing and transporting to Alexandria of the colossal granite bust of Memnon, which lay buried in the sands near Thebes. The manner in which Belzoni accomplished this his first enterprise in his new line of pursuit at once established his character for energy and intelligence. Dressing himself as a Turk, he proceeded to the spot, and there half persuaded and half terrified the peasantry into giving him the requisite assistance in excavating and embarking the statue, till he had the satisfaction at last of seeing it stowed into the boat intended for its conveyance, without having received

any injury, and fairly afloat on the Nile. Having arrived at Alexandria, it was afterwards sent to England, and it is now in the British Museum.

Belzoni had now found his proper sphere, and henceforth his whole soul was given to the work of exploring the wonderful country in which he was, in search of the monuments of its ancient arts and greatness. Sometimes he was employed in the service of Mr. Salt, sometimes on his own account. The next affair which Mr. Salt committed to him was the excavation of the Temple of Ipsamboul, in Upper Egypt, which was so enveloped in sand that only its summit was visible. Belzoni, however, in despite of innumerable obstacles, partly of a physical nature, partly created by the opposition of the natives, at last succeeded in penetrating into its interior. On returning from this expedition, he next undertook a journey to the valley of Beban-el-Malouk, beyond Thebes, where, from a slight inspection on a former occasion of the rocky sides of the hills, he had been led to suspect that many tombs of the old inhabitants would be found concealed within them. For some time he searched in vain in all directions for any indication of what he had expected to find, till at last his attention was suddenly attracted by a small fissure in the rock, which presented to his experienced eye something like the traces of human labour. He put forward his hand to examine it, when the stones, on his touching them, came tumbling down, and discovered to him the entrance to a long passage, having its sides ornamented with sculpture and paintings. He at once entered the cavern—proceeded forward—and, after overleaping several obstacles which opposed his progress, found himself in a sepulchral chamber, in the centre of which stood an alabaster sarcophagus, covered with sculptures. He afterwards removed this sarcophagus, and with infinite labour took exact copies of the drawings, consisting of nearly a thousand figures, and the hieroglyphic inscriptions, amounting to more than

five hundred, which he found on the walls of the tomb. It was from these copies that Belzoni formed the representation or model of this tomb, which he afterwards exhibited in London and Paris.

On returning to Cairo from this great discovery, he immediately engaged in a new investigation, which conducted him to another perhaps still more interesting. He determined to make an attempt to penetrate into one of the pyramids; and was at last fortunate enough to discover in that called the pyramid of Cephrenes the entrance to a passage, which led him into the centre of the structure. Here he found a sepulchral chamber, with a sarcophagus in the middle of it, containing the bones of a bull—a discovery which was considered to prove that these immense edifices were in reality erected by the superstition of the old Egyptians for no other purpose than to serve each as a sepulchre for one of their brute divinities. After this, encouraged by the splendid success that had hitherto attended his efforts, which had now made him famous over Europe, Belzoni engaged in various other enterprises of a similar character, which we have not room to enumerate. He made also several journeys both to the remoter parts of Egypt, and beyond the bounds of that country into the adjoining regions of Africa. At last he determined to revisit Europe; and, accordingly, he set sail for that purpose in September, 1819.

The first place which he visited was his native city, from which he had now been absent nearly twenty years. When he left it last he was an unknown wanderer, without employment or the means of existence, and ready almost to accept the humblest that might be anywhere offered him; he returned to it now with a name familiar over the civilized world, and the glory of many discoveries which had long made him the pride of his fellow-citizens. He presented on this occasion to the town of Padua two lion-headed granite statues, which

were placed by the magistracy in a conspicuous situation in the Palace of Justice; a medal being at the same time struck in honour of the giver, on which were inscribed his name and a recital of his exploits. A copy of this medal, in gold, was presented to Belzoni, accompanied with a letter expressive of the admiration felt by the Paduans for their distinguished townsman. From Italy he hastened to England, where the rumour of his discoveries had already excited a greater interest than in any other country. Here he met with the welcome due to one whose services had contributed to extend the scientific glory of the nation; and, both in the world of letters and in the world of fashion, the celebrated traveller became a chief object of attraction. He now employed himself in preparing an account of his travels and discoveries for the press; and the work appeared about the end of the year 1820, in a quarto volume, accompanied with another volume of plates in folio. It excited great interest, and soon passed through three editions; while translations of it into French and Italian had also appeared at Paris and Milan. It was after the publication of his book that Belzoni prepared his representation of the tomb he had discovered at Beban-el-Malouk which was exhibited in London and Paris.

Tired, however, of leading an inactive life, he soon began to project other schemes of foreign travel. He visited successively France, Russia, Sweden, and Denmark; after which, returning to England, he undertook, under the auspices of the government, to prosecute the perilous attempt of penetrating into central Africa. His plan was to endeavour, in the first instance, to reach Timbuctoo, thence to direct his course eastward towards Sennaar, and then to return through Nubia and Egypt. But even his experience, skill, and extraordinary personal strength and prowess did not save him from falling a victim in the cause in which so many gallant men had

already perished. He left England towards the end of the year 1822 for Gibraltar, on reaching which he immediately embarked for Tangiers. From this he proceeded to Fez, where he was well received by the Emperor of Morocco, and obtained permission to join a caravan for Timbuctoo, which was to set out in a few days. Unexpected difficulties, however, arose when he was on the point of departure; and after a residence at Fez of five months he was obliged to give up all hope of commencing his journey by the route he had originally fixed upon. On this disappointment he sailed for Madeira, and from thence, in October, 1823, he set out for the mouth of the river Benin on the west coast of Africa, with the intention of making his way to the interior from that point. He entered upon this journey accompanied by an English merchant, who was to conduct him as far as the town of Benin, and to introduce him there to the king of the country; but by the time he had arrived at this place a malady, which had attacked him almost as soon as he had set his foot on shore, had reached such a height, that he was unable to proceed any farther; and he begged his companion to have him taken back to Gato. He arrived here on the 2nd of December in a dreadfully exhausted state, and, being immediately attacked with delirium, expired on the following day. His remains were interred under a plane-tree on the shore, while the English vessels on the station honoured his memory by discharges of their cannon during the ceremonial. An inscription in English was afterwards placed over his grave, recording his melancholy fate, and expressing a hope that every European who might visit the spot would, if necessary, cause the ground to be cleared, and the fence repaired, around the resting-place of the enterprising and intrepid traveller.

Many other names of persons of both sexes remain in the records of literature, science, art, and the other departments of intellectual exertion, which might be referred to as illustrating the Pursuit of Knowledge under Difficulties. But the selection of examples we have made, regulated as it has been with a view to give as much diversity of interest as possible to our little work, will probably be thought sufficiently extensive for our purpose. The lesson we would teach is, that in no situation of life, be it what it may, is the work of mental cultivation impossible to him who in good earnest sets about it. What is chiefly wanted to invigorate the mind to the encounter and conquest of the most formidable difficulties which any circumstances can oppose to it is simply a clear conception and abiding conviction of that truth.

We will make only one additional remark. In other pursuits, the most unremitting endeavours often fail to secure the object sought, which, being usually something which only one individual can appropriate, is equally within the grasp of other competitors, some one of whom may snatch it away before it can be reached by him who best deserves it; but in the pursuit of knowledge it matters not how many may be the competitors: no one stands in the way of another, or can deprive him of any part of his chance, we should rather say of his certainty, of success; on the contrary, they are all fellow-workers, and may materially help each other forward. The wealth which each seeks to acquire has, as it were, the property of multiplying itself to meet the wants of all.

But it is not merely as a direction for the student that we ought to account the lesson valuable which teaches how much every man has it in his power to do for himself, if he will but set resolutely about the doing of it; it is still more valuable as a moral lesson. Indeed, if knowledge were not itself one of the supports of mo-

rality, it would not be worthy of the commendations which have universally been bestowed upon it; nor would its diffusion deserve the warm encouragement it has uniformly received from an enlightened philanthropy. But, though it is not true that the man who has accomplished himself in science or literature is always a more virtuous character than he who is without any intellectual culture, there can be no doubt of the generally humanizing and elevating tendency of a devotion to such pursuits; and, more especially, must the best effects be experienced from this dedication of his faculties by him whom it compels to learn and practise, to an extraordinary extent, the duties of steadiness, diligence, husbanding of time, concentration of attention, perseverance, courage, endurance of hardships, and every other habit and quality which depends upon the exercise of self-command or self-denial. In acquiring these virtues he acquires what is more precious than any knowledge, and will go farther to render him a useful and even influential member of society than if he were to make himself master of all the learning that ever was stored up in libraries.

CORRIGENDA.

VOL. I.

Page 1, line 6, *for* "conquerers," *read* "conquerors."

Page 2, line 32, *for* "gentleness," *read* "guilelessness."

Page 5, line 3, *for* "that he seeks—not," *read* "that he seeks something, not."

Page 46, line 24, *for* "cot," *read* "cat."

Page 48, line 9, *read* "LINNÆUS, the founder of modern Botany, although the son of a Swedish clergyman, and himself originally intended for the church, was, from his neglect of his theological studies, about to be taken from school, and apprenticed to a shoemaker; when he was rescued from this fate by accidentally meeting," &c.

Page 50, line 12, *for* "behalf," *read* "behoof."

Page 103, line 10, *for* "different calculus," *read* "differential calculus."

Page 109, line 8, *for* "think what was," *read* "think of what was."

Page 125, line 2, *for* "walked some," *read* "walked for some."

Page 127, line 8, *for* "from earliest years," *read* "from their earliest years."

Page 127, line 15, *for* "they are," *read* "they were."

Page 130, line 4, *for* "and Peace," *read* "and of Peace."

Page 136, line 25, *for* "taken by the Algerines," *read* "taken at sea by the Algerines."

Page 142, line 21. *for* "while assisting," *read* "while still assisting."

Page 147, line 2, *for* "Dudley; North," *read* "Dudley North."

Page 185, line 32, *for* "brought it," *read* "bought it."

Page 186, line 27, *for* "opened a shop," *read* "opened shop."

Page 195, line 15, *for* "his office," *read* "this office."

VOL. II.

Page 236, line 14, *for* "any at all," *read* "anything at all."

Page 299, in heading, *read* "Progress of Optical Discovery."

INDEX.

THE END.

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